OCTOBER 1957 VOL 19 NO 11

MINING WORLD

Wyoming's Uranium Activity Reaches New Peak Page 66

Mining Is Source of Fuels For Jet Propelled Era Page 70

How To Produce Metallic Zinc In A Blast Furnace

Page 58

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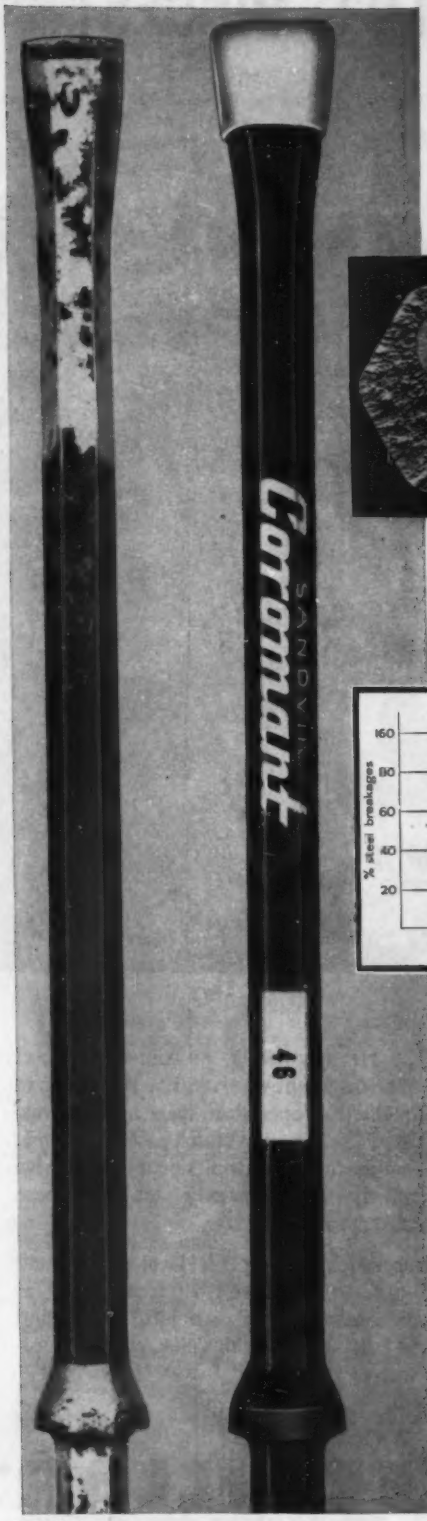

DSS 75A

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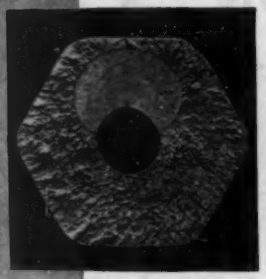

Corrosion invariably lessens the fatigue strength of drill steels and causes earlier breakages. The breakages start from corrosion craters and indentations, around which ever-widening areas of worn surfaces are formed. (See picture of cross-section.)

The main cause of corrosion is moisture—so effective protection of the steels against moisture during both storage and actual drilling eliminates corrosion and gives longer life to the steel. This protection is given to Coromant integral steels by the SR treatment, a new exclusive Sandvik feature.

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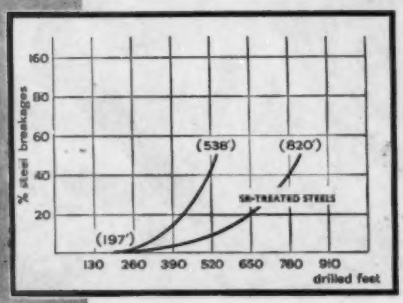
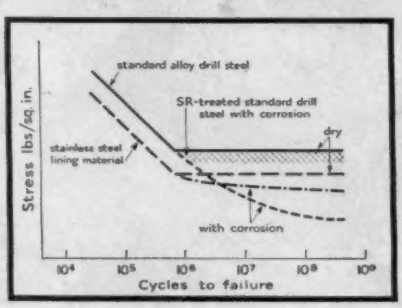
The diagram on the left shows clearly that SR-treated steel rods have a 30%-50% longer working life than those of untreated steels. Figures are based on extensive practical tests, which resulted in an average drilling depth of 820 ft. for SR-treated steels as against 530 ft. for untreated steels, before rod breakage.





HOW SR TREATMENT PREVENTS CORROSION

SR treatment is a new method of surface protection developed by Sandvik. It protects both the wall of the flushing hole and the outer walls from corrosion by a thin but strongly adhesive layer. The fatigue properties of the steels therefore correspond to those valid under dry conditions. On the wall of the centre hole, usually subjected to water flushing, the SR layer is everlasting, and *does not decrease the diameter of the flushing hole*. This is a distinct improvement on the old means of coating the centre hole with stainless steel, which lessens the diameter of the flushing hole, prevents full and effective flushing, and thus diminishes the drilling rate. Moreover, stainless steel has a lower fatigue strength than standard alloy drill steel.

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Published monthly except in April when publication is semi-monthly

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BY S. W. K. MORGAN

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BY SEI ARAKANE

Mitsubishi Metal Mining Company has reduced fuel consumption, increased recovery, and lowered costs at its Naoshima, Japan smelter by installing automatic controls. This is world's first smelter to recover zinc by fuming copper slag.

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Mining Congress meets in Salt Lake City, Utah to discuss state of the industry. Optimistic reports received on tariffs for lead and zinc by year's end.

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ON THE COVER

Prime Western grade zinc is one of products of Imperial Smelting's new blast furnace smelting process. Lead bullion is the other product of a mixed zinc-lead furnace charge. This new process opens a new era in treating zinc bearing material with a wide range of associated lead. Picture shows casting of zinc slabs at Avonmouth, England.

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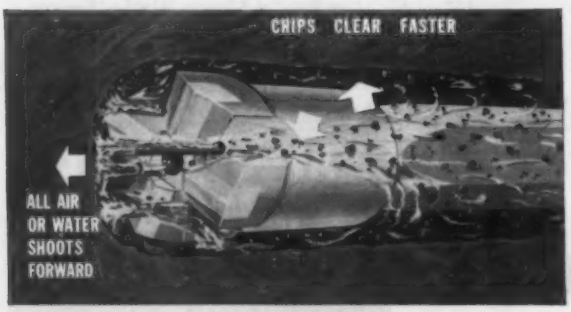

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Drifts and Crosscuts

The Paradox in Copper

Copper production and copper demand present a strange paradox. Copper production from mines in the United States for the first six months, on an average daily basis, was up slightly from the 1956 daily average—3,083 tons versus 3,006. Refinery production, domestic plus foreign, was also slightly up to 759,336 tons from 746,818 in the same 1956 period.

There has been no appreciable change in foreign mine production despite reports to the contrary. The Chilean government which obtains its major income from copper has dictated that output must remain high in the face of lessening income under falling copper prices. There has been more talk than true cutback in Northern Rhodesian production. Belgian Congo output remains relatively stable.

Copper demand is down and that has caused the drop in producer's price of more than 38 percent in a little over a year, while the custom smelter price-off has been even greater—about 50 percent. Unsold copper stocks have reached an eight-year high of more than 500,000 tons.

Thus we have token curtailment in the face of shrinking demand and price. What would appear to be a basic economic law would be to shrink back production. Instead, many United States companies are making strong and continual efforts to cut production costs. They must cut costs to maintain profitable operations to offset the continuing over-all cost spiral in a general inflation era.

For many large mines, both open pit and underground, the best opportunity to cut costs is to raise volume. In fact, several of the large new mines have been engineered and developed for large tonnages. They either operate at maximum capacity and efficiency or they don't operate at all. They can't close a block-cave stope here, or shut down a primary crusher there.

Thus they defeat the economic law of supply and demand by trying to cut costs.

And new production is coming onto the market from announced and unannounced expansions in Peru, Chile, Belgian Congo, Australia, Northern Rhodesia, Canada, the Philippines, and right here in the United States.

As the copper price has dropped, there has been no pickup in demand. On the contrary, buying appears to have slowed. Consumers have been using up inventory in the correct belief that this over-production would drive prices still lower.

Today's copper price is below the cost of production at many mines. It has reached the point where it is cheaper to shut down some mines than to keep on producing.

Everyone is waiting for some one else to make drastic cuts in production. Chile may well be the key. Without important cuts there, no one likes to see his mine shut down. Chile must hope for another sale of 100,000 tons of copper to the United States government to bail it out, as happened several years ago.

Copper supply and demand must be brought into balance. Some one must be the leader.

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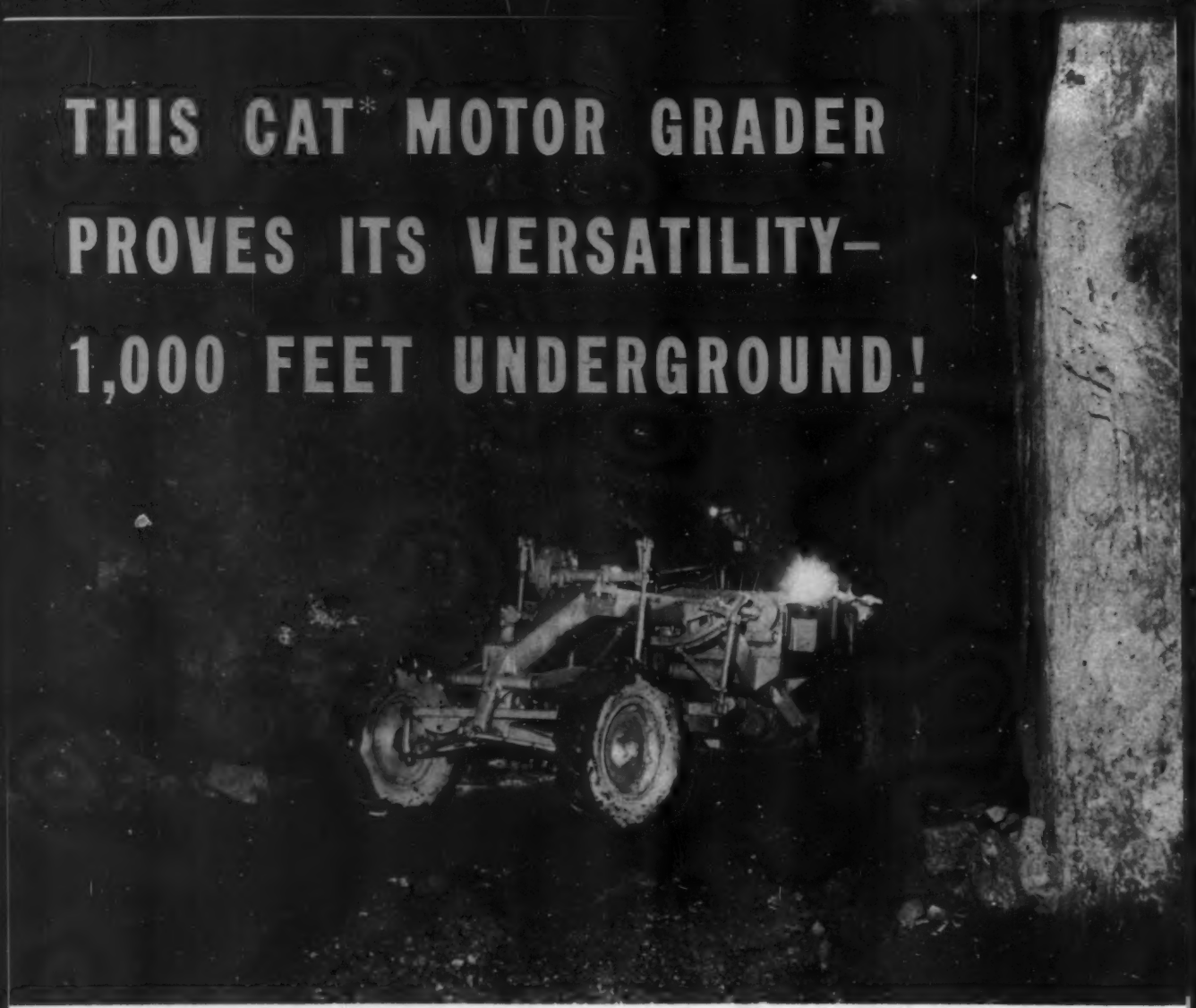

EIGHT MILES of underground road that lace through a large lead-zinc mine in northeast Washington State are being maintained by a Cat No. 212 Motor Grader. It has put the roads in such good shape that substantial savings are being realized on the mine's hauling equipment. And, above ground, the versatile machine maintains 1½ miles of company road and handles snow removal.

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Their engines are tough, simple, dependable—burning low-cost fuels such as No. 2 furnace oil without fouling. They're easy to operate, with positive-acting power controls and short radius turns. No need to stand up to see the wheels, the blade or the job. The blade can be changed from ditching to bank-sloping in less than a minute from the driver's seat. Cat Motor Graders are ruggedly built throughout—to stand up to steady work with a minimum of down time.

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MINING WORLD NEWSLETTER

. . . . London . . . . Avonmouth . . . . San Francisco, October 1957

An upswing in metal prices by the end of the year is anticipated by many metal companies in England, Sweden, and Germany, according to Max F. Holsinger, general manager of MINING WORLD and WORLD MINING, who is currently establishing a European headquarters for expansion of the magazines' services to the industry.

The continued industrial boom in Europe is the reason for the optimistic view.

Most heavy equipment firms are operating with a 16- to 24-month backlog of unfilled orders, and no signs of a letup are evident.

The rapid rise in per capita consumption of metals for consumer goods, appliances, and automobiles at rates never anticipated before the war is especially apparent in Sweden and Germany.

Revolutionary changes in the zinc smelting industry are being made.

Simultaneous recovery of lead and zinc in a blast furnace has now been proven commercially feasible.

First pilot plant operation is at Avonmouth, England, where Imperial Smelting Corporation is producing 70 tons of zinc per day. Mixed zinc-lead-sulphide ores and concentrates are treated to yield metallic zinc, while the lead content of the charge is recovered simultaneously as lead bullion.

Chief advantages of the process as compared with normal retort and electrolytic operations include: high-capacity units; ability to furnace a difficult mixed charge which had presented differential problems; ease in treating high iron-zinc concentrates.

First commercial plants will probably be built in Australia. Sulphide Corporation plans a plant in New South Wales, while American Smelting and Refining Company reportedly has been interested in an installation for its Mount Isa operations in Queensland.

U.S. zinc metallurgists will watch Australian progress with interest.

Meanwhile, slab zinc consumption during 1957 promises to be over 900,000 tons.

A continued high is predicted by the American Zinc Institute, despite current unbalance between production and consumption, drop in zinc prices, and "wait and see" attitudes of many zinc purchasers.

Growing demand for zinc to galvanize steel, and steady uses for die castings and in rolled forms, brass, and zinc pigments are expected to sustain the industry.

The search continues for new metal uses and better processes.

A new process for zinc plating is being tested. Wagner Brothers, Inc. believe they have solved past difficulties in using zinc as the initial layer under copper, nickel, and chrome.

High melting point metals can now be produced inexpensively through a method developed at Illinois Institute of Technology. Titanium, zirconium, chromium, hafnium, columbium, and vanadium can be produced directly from their oxides with this process.

Special steels are being developed by U.S. Steel Corporation researchers for manned aircraft and guided missiles.

Ultra-pure metals can be produced by means of an automatic refining device developed at Bell Telephone Laboratories. Among other things, it can be used to purify germanium, molybdenum, and tungsten.

In carrier landings, planes coming in at more than 100 knots are stopped in a split second. This amazing performance is made possible by having each plane hook onto one of several wire ropes stretched across the flight deck. Both plane and rope receive an almost unbelievable shock at the moment of contact. Needless to say, only top-quality wire ropes can be used for this application because . . .

you can't bargain with safety

While your use of wire rope differs from this carrier application, *safety should be just as important to you.* For, although a "bargain" rope may save you money, it can cost you your peace of mind. So don't bargain with safety. Buy a rope that's a *quality* rope—buy Wickwire Rope. 5049

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Capitol Concentrates

Lead-Zinc Program Never Reaches Vote; Appeal To Tariff Commission Planned

Congress has adjourned and left to the Tariff Commission—and the President—the decision concerning tariff aid for the lead-zinc industry. All legislative avenues of relief were blocked when the House Ways and Means Committee, through Chairman Jere Cooper, refused to approve a measure which would have imposed a sliding scale of import taxes on lead and zinc ores and metals.

The next step is for the industry to appeal to the Tariff Commission for relief. President Eisenhower, in a letter to Chairman Cooper, indicated that it was his understanding that the lead-zinc producers would take such a course. "In that event," he added, "I would request the Tariff Commission to expedite its consideration of the matter."

At his press conference on August 21, 1957, President Eisenhower discussed the Administration's proposal for sliding-scale tariffs on lead and zinc. Out of a welter of misinformation the following quote is notable: "I actually believe the best way, in the long run, to handle these things is through the established method which is to put it into the Tariff Commission and allow the study to be made, and then for the President to act on it in accordance with the existing law."

Facts which seem to be forgotten include the following: (1) In 1954, under similar circumstances, the President refused to act under Tariff Commission recommendations; (2) The bill before the Congress is an Administration bill, although support by the Interior and State departments is only lukewarm; (3) The bill provided inadequate relief therefore needed amending; and (4) The Lead-Zinc Emergency Committee was merely pressing for a bill, the principle of which was drafted by the Administration itself. Thus, if it is against Administration trade policy, only the President was to blame.

Now, within just a few weeks of Secretary Seaton's transmittal of this portion of the "long-range" mineral policy to the Congress, and in the crucial closing hours of the session, the President in effect told the industry representatives that in following his lead they took the wrong course.

With speedy action by all concerned, tariff relief could be provided before the end of the current year.

The history of the lead-zinc legislation during the session of Congress just ended may be summed up in a few words. Industry did not like the Administration bill, the Administration did not like the industry bill, and the House Ways and Means Committee did not like either bill. The President dealt a body blow to the backers of his own legislation by stating at a press conference that the proper procedure—and the one he preferred—was an application to the Tariff Commission for relief under the escape clause. That statement gave "aid and comfort" to the chairman of the Ways and Means Committee, who feared a precedent created by relief for the lead-zinc industry would cause many other industries to seek remedial legislation.

The question which history cannot answer at this time is why the President did not ask for Tariff Commission action in the first place. Months of time have been lost, not to mention the millions of dollars which lead-zinc producers have lost as a result.

• *Tariffs vs. Import Excise Taxes*

Considerable confusion has been evident over the various terms used for various duties authorized by legislation. Whether a duty is called a tariff or an import excise tax makes not one bit of difference as far as its ultimate effect upon prices and imports. It appears, however, that tariffs are handled by the Bureau of Customs and import excise taxes by the Internal Revenue Service—both being under the Treasury Department. In all probability both duties are collected in the same manner. Aside from the fact that "Import Tax" gets away from using the dirty word "tariff," it appears that this slant was taken in the Administration lead-zinc bill because amending the Internal Revenue Code was considered to be the easiest route.

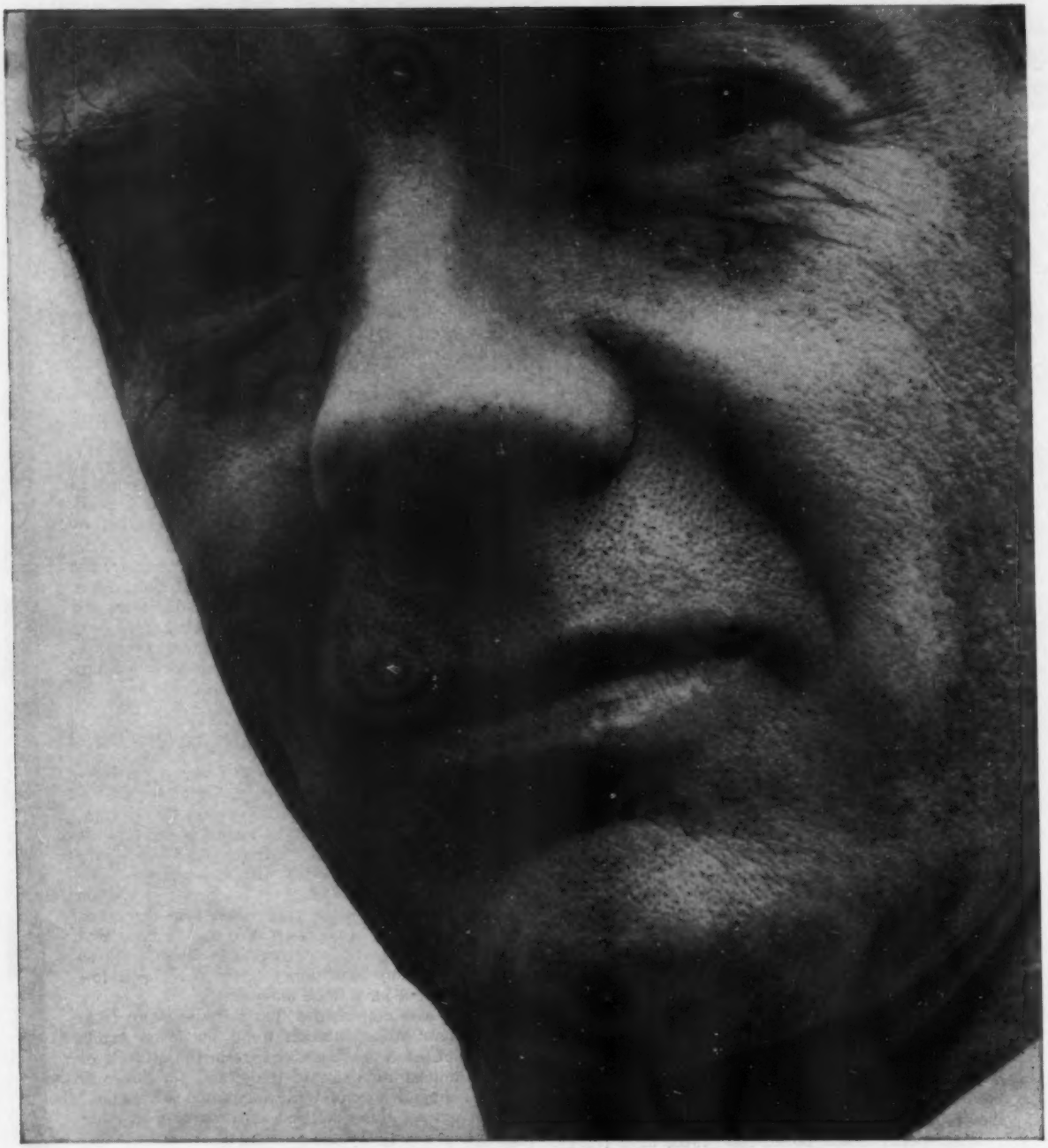
• *Secretary Dulles Gives His Opinion*

When asked about the lead-zinc import tax legislation, during a press conference, Secretary of State Dulles said: "Well, the stockpiling program has come to an end. The price of most metals is rather weak at the present time and the situation is back (the 1953 situation) to be dealt with in some way. The program for dealing with it, as I understand it, is on a sliding-scale basis, so that when prices recover, then the duties will go down. We can all hope that there will be a revival of strength in these metals so that in fact any new duties based only upon low prices will not have to be maintained."

Dulles also emphasized that this departure from the general Administration trend for lower tariffs "does not mean any basic change in the attitude of this Administration toward trade, and our desire to have a liberal flow of trade to mutual advantage." Observers see this statement as a warning to other industries not to try the same route.

• *Kirwan's Antagonism Is Unchanged*

Representative M. J. Kirwan of Ohio was the one who scuttled the ship for the domestic tungsten producers. Shortly before Congress adjourned he was approached with the question, "As the domestic industry now is ruined and many mines have stocks on hand, accumulated during the period when it was not known if the Congress might approve financing Public Law 733, would you go along with an appropriation to bail out the stocks on hand at the mines at a price which would prevent loss?" His answer was, "Not one cent."



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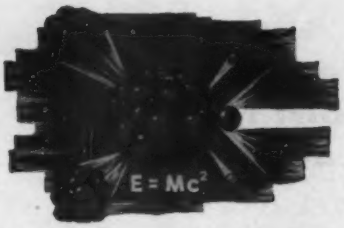

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Monthly Roundup of Mining News In the Atomic Energy Field

Five Uranium Firms Plan Merger as Hidden Splendor

The largest independent uranium mining company in the United States will be formed from five companies controlled by the Atlas Corporation. Atlas's 100 percent subsidiary Hidden Splendor Mining Company, the surviving firm, will have assets valued at more than $100,000,000, according to Floyd B. Odlum, Atlas Corporation president.

Companies merged into the new company and their operating mines and milling interests are: Lisbon Uranium Corporation, operating the Columbia and Ike mines in Utah's Big Indian district and owning a substantial share of Uranium Reduction Company which formally dedicated its new uranium mill at Moab on September 14th; Hidden Splendor Mining Company, which operates the Almar mine in the Big Indian district; Rio de Oro Uranium Mines, Inc.'s with its Dysart No. 1 mine in Ambrosia Lake, New Mexico, and Rio de Oro's interest in the new mill being built by Homestake-New Mexico Partners at Grants, New Mexico; Radorock Resources, Inc. and Mountain Mesa Uranium Company, which operate the Radon mine in the Big Indian district. Ore production of the new company will be 35,000 tons per month initially.

The new company will control 12 ore bodies in the Big Indian district, three in Ambrosia Lake, and one in the Gas Hills district of Wyoming. In addition a large number of properties are currently being explored by the merging companies. A greater participation in uranium milling is sought by participation in uranium mills now in the planning stage in the Gas Hills district and Ambrosia Lake.

Headquarters of the new company will be in Salt Lake City, Utah, with A. P. Kibbe, president of Lisbon, as president of the new company.

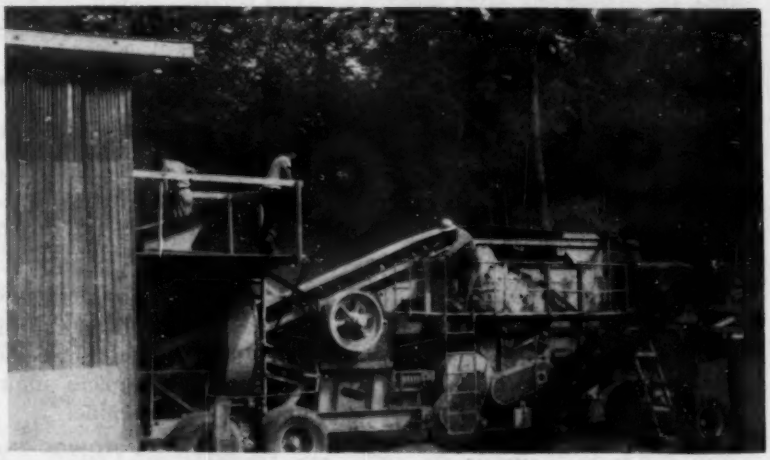
Deep Drilling Finds Two Ambrosia Lake Ore Bodies

Two additional uranium ore bodies have been indicated by deep drilling in Ambrosia Lake, McKinley County, New Mexico. Rare Metals Corporation of America has indicated an ore body with sufficient tonnage to warrant a mill at a depth from 940 to 1,000 feet below the surface. Drilling is continuing to further delimit the deposit in Section 23, T. 13 N., R. 9 W.

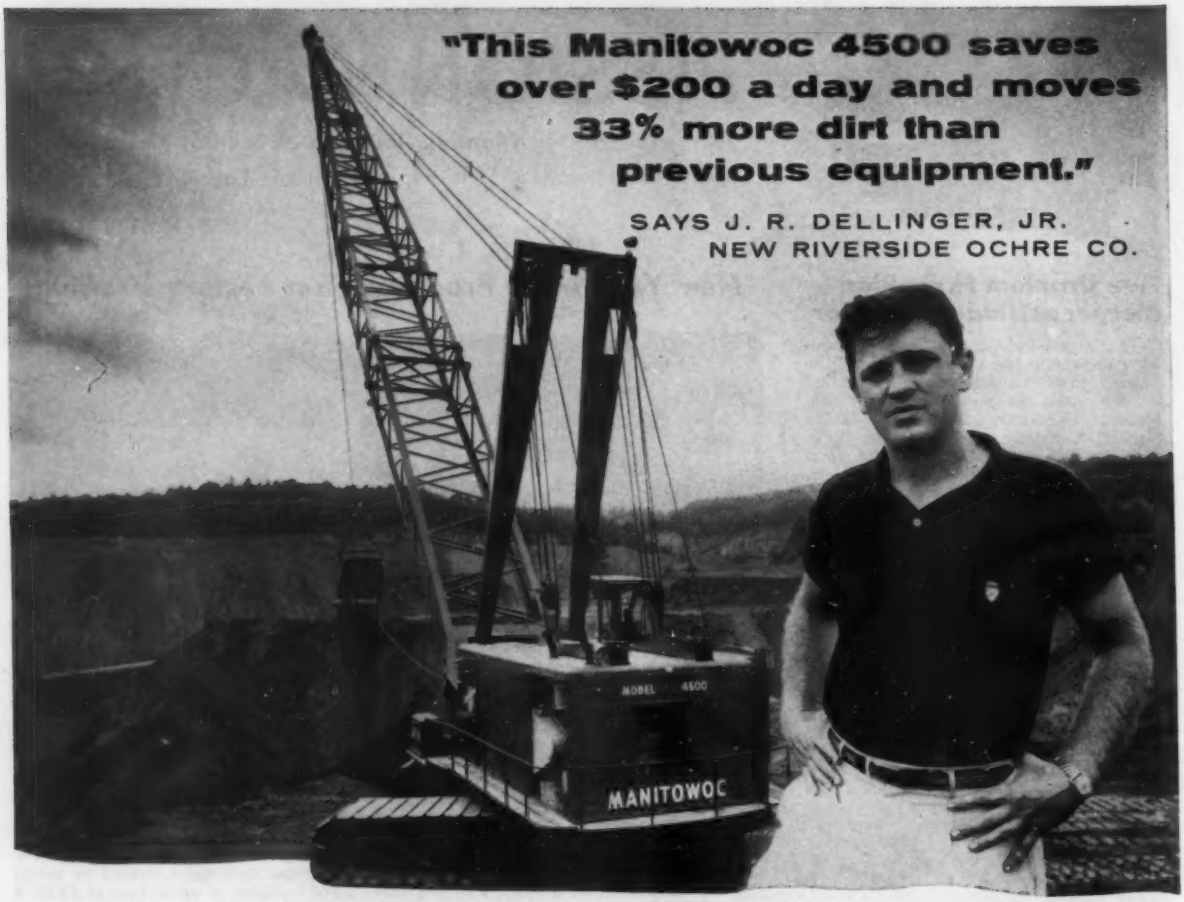
Another ore body is indicated by six holes on 150 foot centers cutting mineralization assaying 0.47 percent U_3O_8 in Section 32, T. 14 N., R. 8 W. These holes were drilled under contract by E. J. Longyear Company for Lisbon Uranium Company and Mineral Project B. Ltd. Mineral rights for the area were originally held by Yucca Mining and Petroleum Company. Drilling in sections 15 and 16, T. 14 N., R. 8 W. is reported to have also found mineralization.

New York Mine Produces First Eastern Uranium

Ramapo Uranium Corporation, with headquarters in New York City, and uranium mines 60 miles northwest, near Warwick, New York, has placed its new 160-ton-per-day crushing plant and magnetic mill in operation. Uranium at this unusual operation occurs associated with pyrite in magnetite; in fact, iron ore was mined from veins in the area many years ago. A New Jersey prospector, William Mania, discovered uranium with a Geiger counter in the dump of one of these old iron mines. Mania leased the area to the Ramapo Corporation headed by Sidney Lieberman who obtained a contract to ship up to 50,000 pounds of concentrate at $8.00 a pound to the Atomic Energy Commission's Feed Material Plant at Fernald, Ohio. Underground exploration is underway while most of the ore for the new plant is coming from the open-pit mine pictured here.



Ramapo has operated a pilot plant for several months to learn how to separate the uranium from the magnetite and gangue. Results were successful using dry grinding, rejection of a barren tailing by magnetic separaters, and gravity separation of the uranium (uraninite) from the magnetite. The recently installed portable crushing plant is shown in the picture above. The operation is unique in that there is no true tailing. The uranium is sold to the government, the gangue is sold to a local contractor for fill, and the iron concentrate will be sold as iron ore. Ramapo has the distinction of being the only United States company to have a contract to mine and sell uranium east of the Mississippi River.


"This Manitowoc 4500 saves over $200 a day and moves 33% more dirt than previous equipment."
SAYS J. R. DELLINGER, JR.
NEW RIVERSIDE OCHRE CO.
MODEL 4500
MANITOWOC

The New Riverside Ochre Company, Cartersville, Ga., increased the output of barite ore by one-third after putting a Manitowoc 4500 dragline to work in the company's open pit mine. "In addition, the 4500 easily saves us $200 a day in labor and operating costs," says Mr. James R. Dellinger, Jr., partner in the operation.

2400 Yds. per shift

The overburden runs between 30' and 65' deep. Equipped with a 140' boom and 4½-yd. bucket, the 4500 first strips the overburden then excavates and stockpiles the ore for weathering. A week later the ore is shovel-loaded into trucks for washing and breaking. Present output is running about 2400 yards per 8-hour shift. Before the Manitowoc 4500 came on the job, output was limited to 1600 yards each shift, excavated by two shovels — a 1½-yd. and a ¾-yd. unit.

Saves $200 a day

Use of the big 4500 has cut labor and operating costs by more than $200 a day. The drag handles a yard of dirt for 7 cents, compared to the 25 cents a yard with the old, two-shovel method — a saving of $230 a day, *plus* the increase in production! With the ore running 75 to 100 feet deep, the Manitowoc's lower cost per yard of material moved allows the company to mine at extreme depths and still show a profit.

Selective Mining Possible

Because of the Manitowoc's long reach and accurate control, selective mining is now possible — casting off the overburden to one pile and ore-bearing earth to another. Thus, the grade of ore obtained from "spotty" areas intermingled with overburden is improved. The shovels used previously could not economically reduce the amount of dirt mixed with ore.

Single Power Package

The Manitowoc 4500 offers big capacity with all the advantages of a single diesel power package. You get greater simplicity, more efficient utilization of power and more mobility. Unit drive eliminates involved electric motors, control boards, miles of wiring and the deadweight and wasted space this equipment requires. There's no restrictive cable dragging from the machine to prohibit mobility . . . no expensive power installations anywhere. The 4500 follows the ore to any spot on your mine.

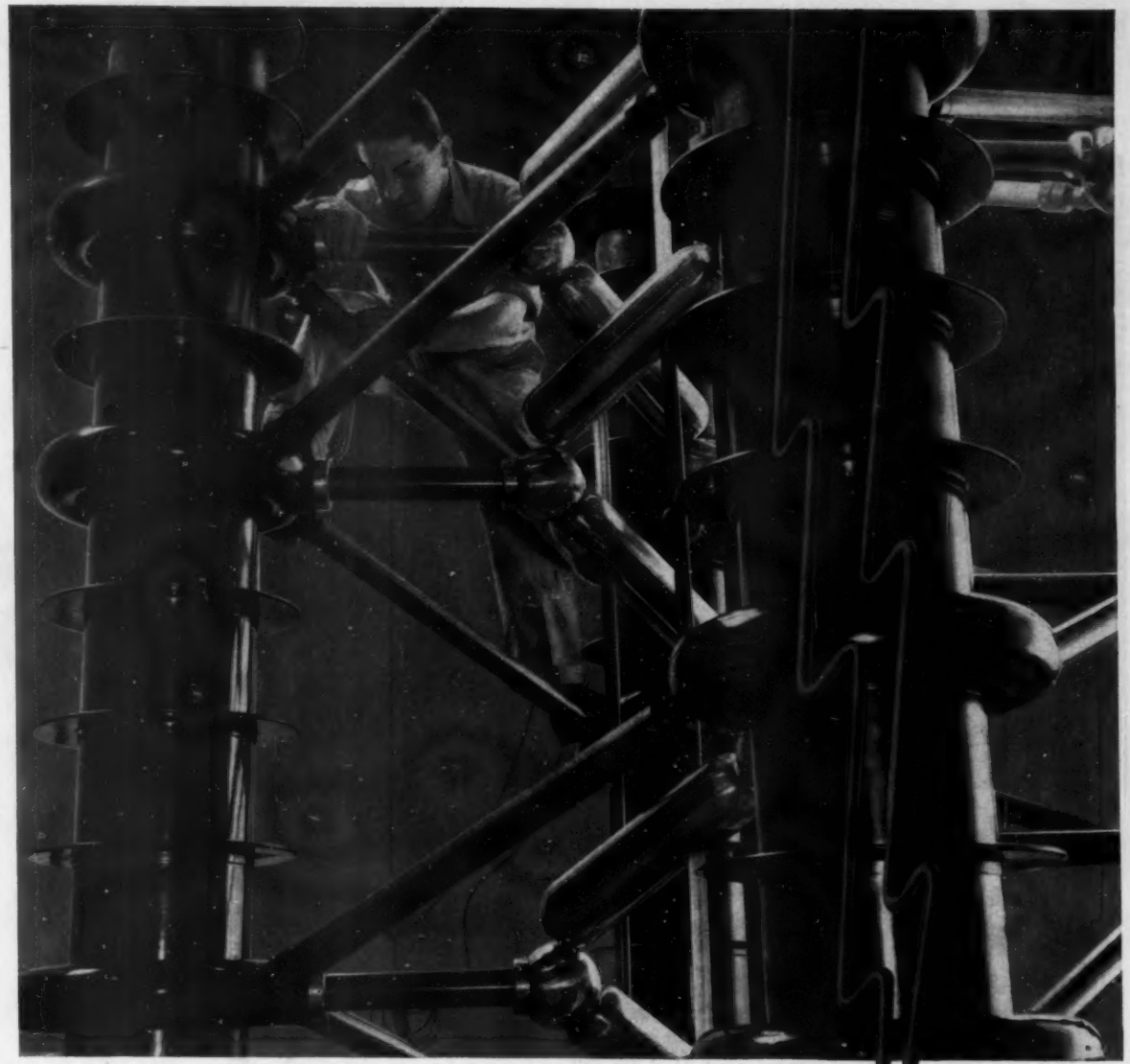
There's much more to the profitable Manitowoc 4500 story. See your Manitowoc distributor for complete information on this amazing mining machine!

MANITOWOC ENGINEERING CORP., MANITOWOC, WIS.

SHOVELS 1-5½ YD.

Manitowoc

CRANES 20-100 TON



Simplex Wire & Cable Company's new 1,400,000 volt impulse generator — the first of its kind to be installed in North America — represents just one aspect of research at Simplex. Simplex scientists and engineers originated the process of vulcanizing portable rubber cords and cables in a lead mold. Simplex developed the first heavy-duty portable electrical cable — Simplex TIREX. The first truly moisture-resistant rubber insulation was the outcome of a commercially acceptable method of deproteinization developed by Simplex. Simplex designed the first interlocked armored cable for underground service — Simplex CONDEX. And now — Simplex C-L-X — the portable, corrugated metallic duct WITH SEALED-IN CABLE. **SIMPLEX WIRE & CABLE CO.**, Cambridge, Massachusetts and Newington, New Hampshire.

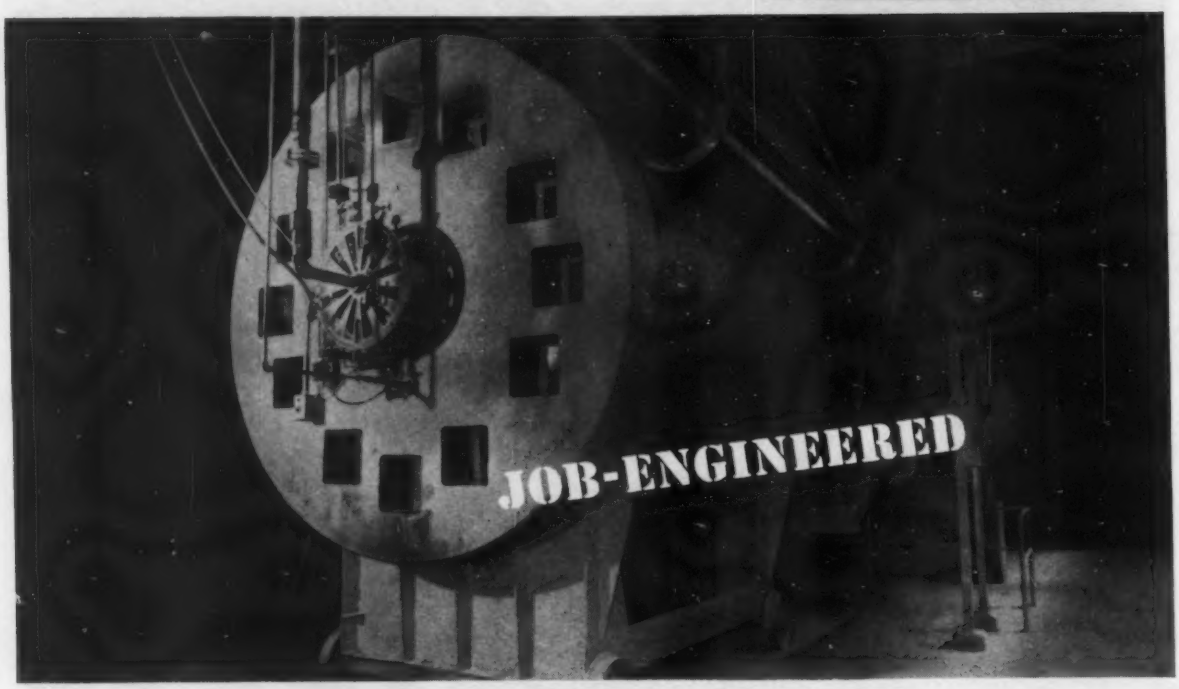
Simplex

LIVE BETTER ELECTRICALLY

Highest quality cables for: Mining • Power & Lighting • Construction • Transportation • Communications • Signalling

Helping others produce a better product...

STANDARD HERSEY DRYERS



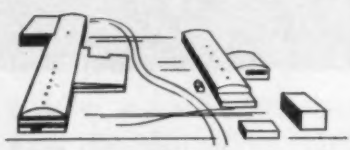
MINING FOR FOOD TO FEED THE EARTH— NEW CARLSBAD PLANT OF NATIONAL POTASH IS ON STREAM WITH STANDARD-HERSEY DRYERS!

Deep into the earth—1800 feet, deepest in the nation's potash industry—National Potash near Carlsbad, N. M., is mining for food to feed the earth, so that the earth will feed man better! Designed refinery capacity is 400,000 tons per year. And at the heart of this operation are 60-foot-long twin rotary dryers—*job engineered* Standard-Hersey dryers—designed and built by Standard Steel Corporation... a world leader in designing and manufacturing dryers, granulators, and coolers. Wide range and flexibility in Standard-Hersey dryers help you to produce almost any desired grade of fertilizer.

No matter how tough the problem, Standard Steel's *job engineering* solves it.

IF YOU HAVE A PROCESSING PROBLEM!

Standard Steel welcomes the opportunity to discuss with you any problems you may have in drying, cooling, or calcining. Our laboratory pilot testing equipment determines beforehand the best equipment for your problem.



STANDARD STEEL ACQUIRES LEADER IRON WORKS

Leader SINCE 1888

To meet the ever increasing needs of its world-wide customers, Standard Steel Corporation recently purchased the Leader Iron Works at Decatur, Illinois. Founded in 1888, Leader is well known for its work in the food, chemical and petroleum industries. In addition to its customary fabrication Leader will now manufacture Standard's line of heavy processing and road construction equipment.

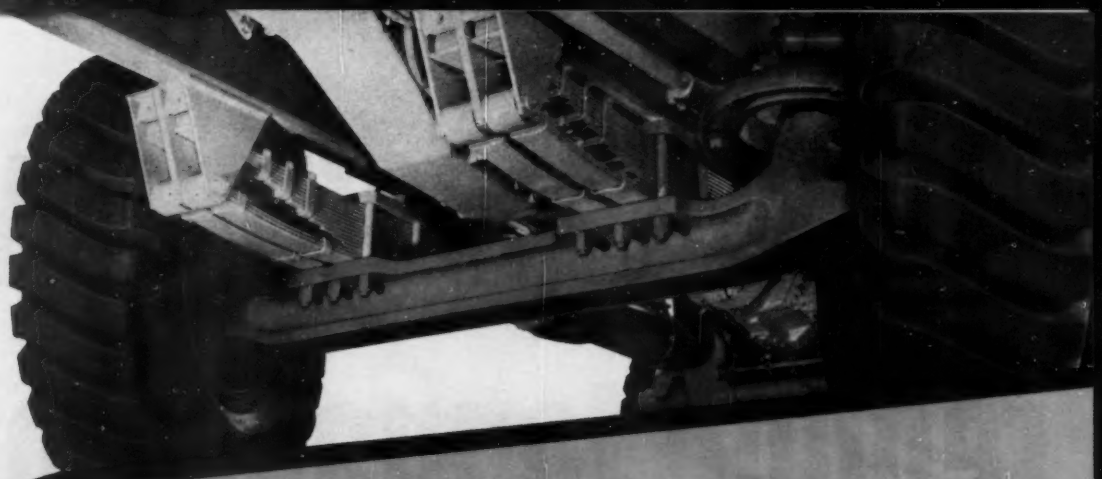
STANDARD STEEL CORPORATION

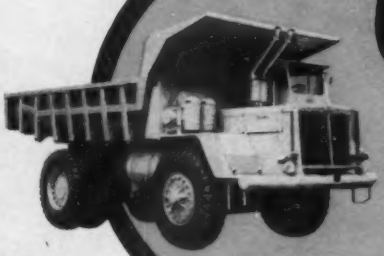
General Offices & Plant, 5031 Boyle Avenue, Los Angeles 58, California

Midwest Offices & Plant **LEADER IRON WORKS** *Decatur 31, Illinois*

(Division of Standard Steel Corporation)

ROTARY DRYERS · KILNS · COOLERS · ASPHALT PLANTS





You Won't Bend this One!

50,000 LB. CAPACITY FRONT AXLE

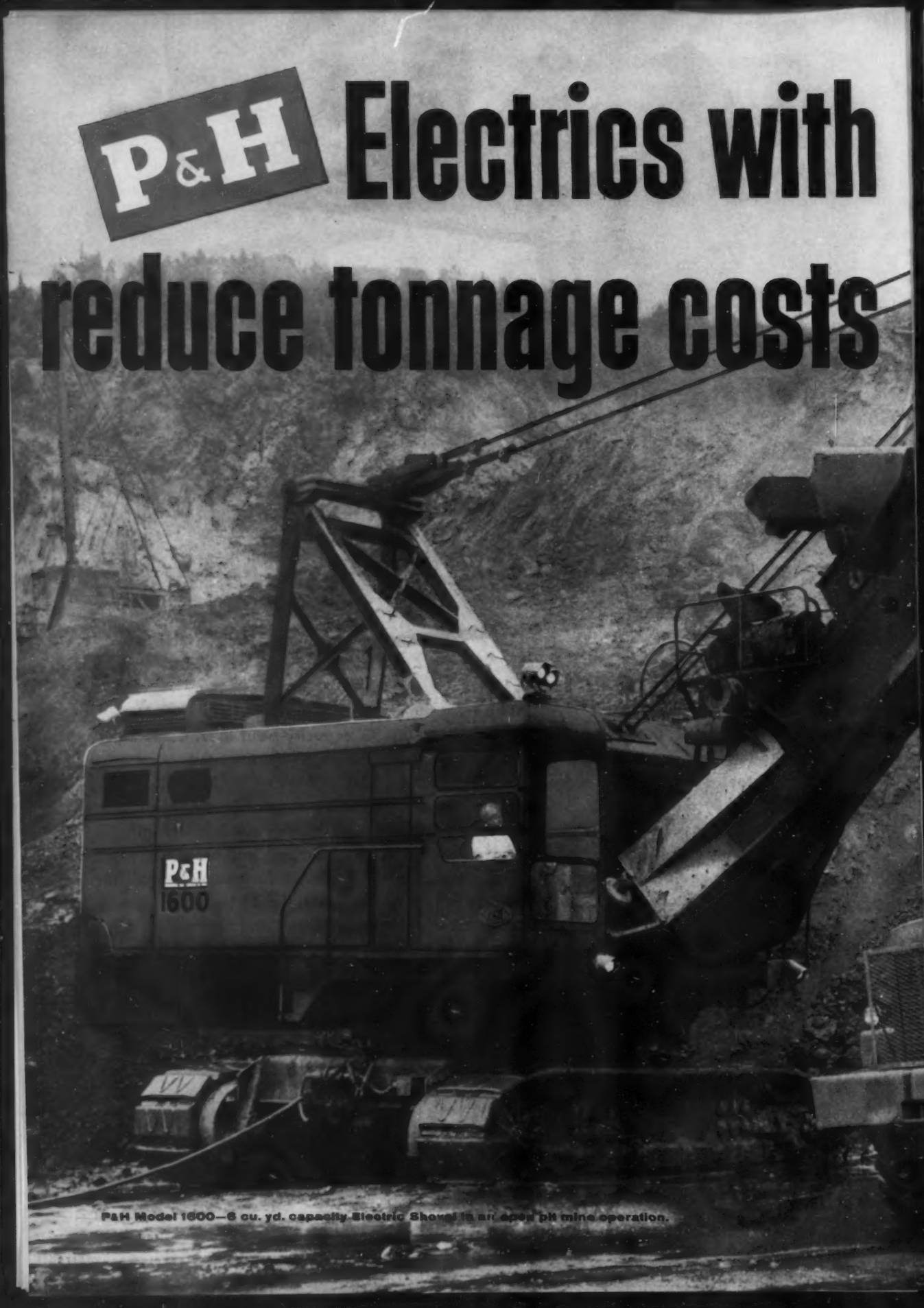
Kenworth's 803 end-dump is built big all over—from its variable section frame to its all-welded steel body. And, this is especially true of the 50,000 lb. capacity front axle. Completely Kenworth engineered and built, this front axle has an 8" heat-treated, alloy steel, I-beam center section; 3" diameter king pins with nylon bushings, and 6" diameter spindles at inner wheel bearings. Over the roughest terrain, where an ordinary heavy-duty axle would not stand the going, this one has strength to spare. That's typical of all Kenworth's spring-mounted rock and ore movers—every one built for big loads and rough roads. There's one for your job—from the 36-ton Kenworth 803, to the 18-ton 801, the 24-ton 802, the 48-ton 802-B, or the 64-ton 803-B. Ton for ton, each of these rugged rock and ore movers is engineered in every detail for greater strength, lower maintenance, longer life. Now's the time to help yourself to consistently increased profits—learn why . . .

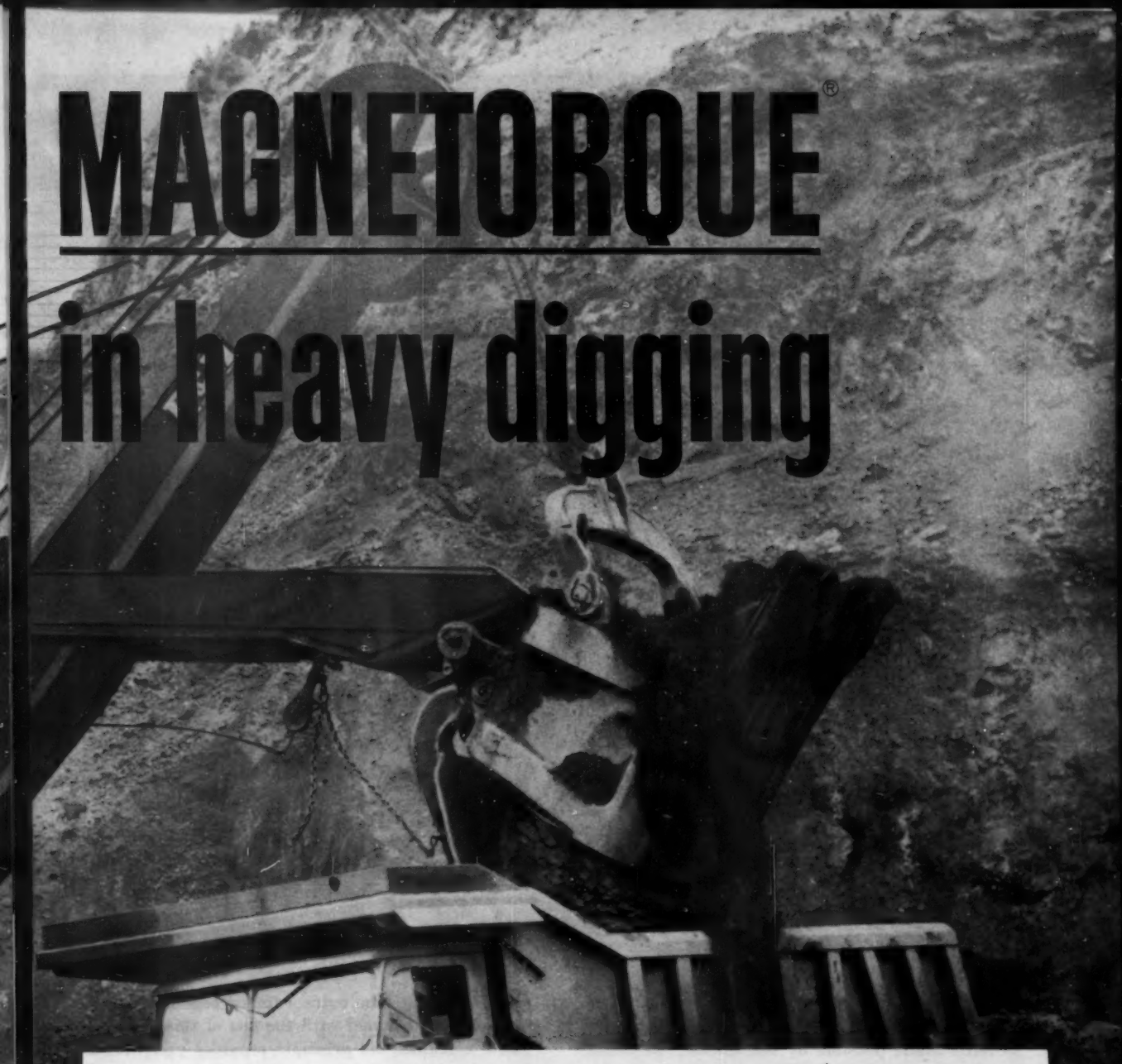
...There's more WORTH in KENWORTH

KENWORTH

MOTOR TRUCKS

FACTORY AND HOME OFFICE: SEATTLE, U. S. A., DISTRIBUTORS IN THE UNITED STATES AND MOST FOREIGN COUNTRIES


P&H Electrics with
reduce tonnage costs
P&H
1600
P&H Model 1600—6 cu. yd. capacity Electric Shovel in an open pit mine operation.



MAGNETORQUE®
in heavy digging

Exclusive P&H MAGNETORQUE® hoist drive puts more power into the bank when you need it, working smoothly, steadily and efficiently under progressively tougher digging.

MAGNETORQUE transmits power from the shovel hoist motor to the dipper magnetically for faster action and at the same time, eliminates shock and impact to the hoist gear train and motor. Response is immediate to varying load conditions.

ELECTRONIC CONTROLS, exclusively designed and built by P&H, provide fastest action of any type of control known. All shovel motions are smoother, resulting in consistently higher output.

With MAGNETORQUE, P&H ELECTRONIC CONTROLS and P&H scientific weight distribution you get higher line pull per cu. yd. of dipper capacity resulting in increased dipper fill factor . . . more production at lower cost.

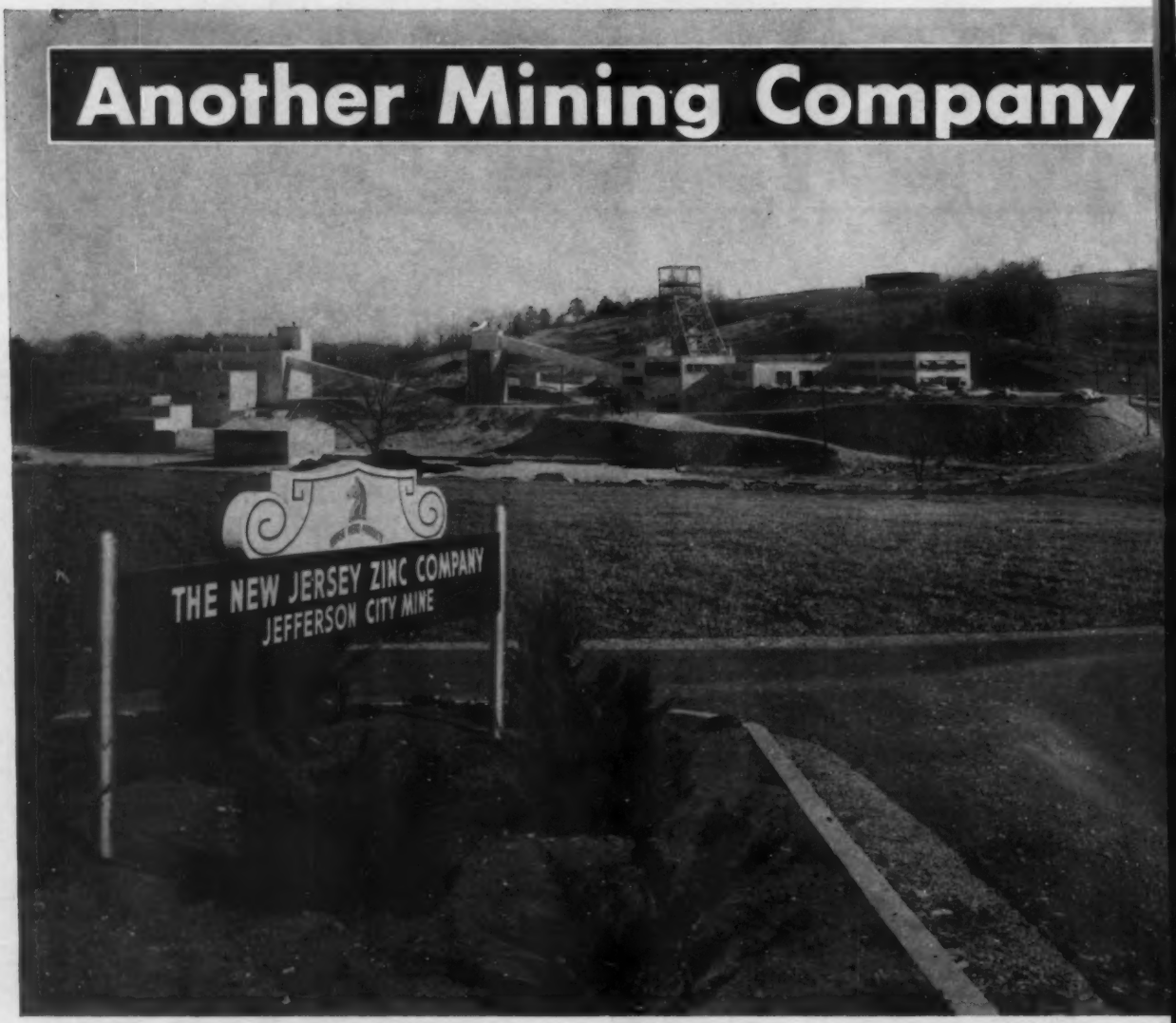
P&H designs, manufactures and applies all electrical equipment specifically for electric shovel service.

P&H Electric Shovel Line:
3½ through 8 cu. yd. capacities

HARNISCHFEGER

CONSTRUCTION & MINING DIVISION
Milwaukee 46, Wisconsin

Another Mining Company



This is a new important mining operation that is taking advantage of the cost saving benefits made possible by the Gismo Self-Loading Transport. The Jefferson City Mine of The New Jersey Zinc Company is an example of the result that can be obtained by careful planning, design and selection of equipment.

This Gismo machine makes it possible for you to devise and organize a simple mining method. We believe the lowest cost possible is obtained when your plan provides for the fewest pieces of equipment, supplies and men. The Gismo is simple, versatile — mucks in development or production, can drill as a jumbo, make its own roadways, etc. It can transfer its load direct to cars by means of ramp cars . . . or direct to cars or trucks by means of ramping-over (see circled photo at right) . . . or direct to surge pocket for transfer to a common haulage system or method.

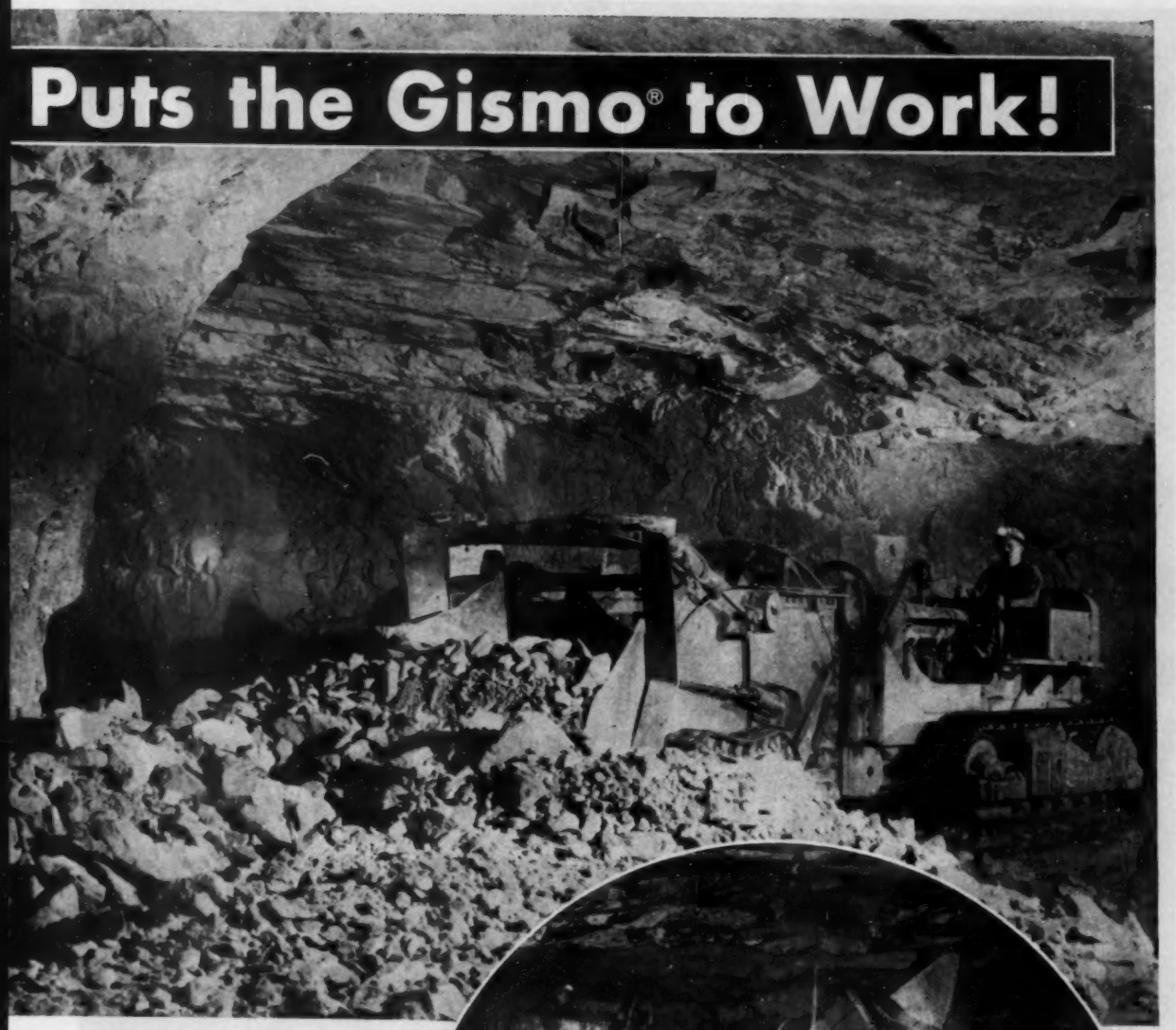
Investigate the extraordinary economies that have been obtained with the use of this remarkable machine. Its principle provides you with a new fundamental opportunity to devise ways and means of cutting costs that you have not had for many years. Write us today. Sanford-Day Iron Works, Inc., Knoxville, Tenn.

SANFORD-DAY

KNOXVILLE, TENNESSEE

SUPER MARKET FOR MINE CARS — all types . . . PRECISION WHEELS . . . BROWNIE HOISTS . . . GISMO SELF-LOADING TRANSPORT that loads in development or production . . . transports . . . supports 2 to 5 jib mounted drills . . . back fills . . . moves boulder rocks . . . makes its own roadways and cleans up completely — a new method of hard rock mining offering a tremendous reduction in cost per ton!

Puts the Gismo® to Work!



THE NEW JERSEY ZINC COMPANY'S Jefferson City Mine incorporates the latest and most modern equipment, including the Gismo, S-D Ore Cars and S-D "Brownie" Hoist. Above you see the Gismo mucking out a load. Circled photo at right shows the ramp-over-cars' transfer point. One man, the Gismo operator, handles the entire operation by means of push-button control of the S-D "Brownie" Hoist. Operator's control lever is located just below roof above the ramp. The S-D "Brownie" Hoist automatically moves trip when another empty car is positioned under ramp. Operating arm located beside cars "tells" hoist when to stop the trip. The S-D Ore Cars haul production to ore pass.

"Modern Copper Concentrator at Silver Bell, Ariz., for American Smelting & Refining Company"

WHEN THE GOAL IS PRODUCTION

Planning for successful operation begins with preliminary designs and cost estimates. From start to production, assign Stearns-Roger the task—one order, one responsibility for design, engineering, procurement and construction. For new plant or modification,

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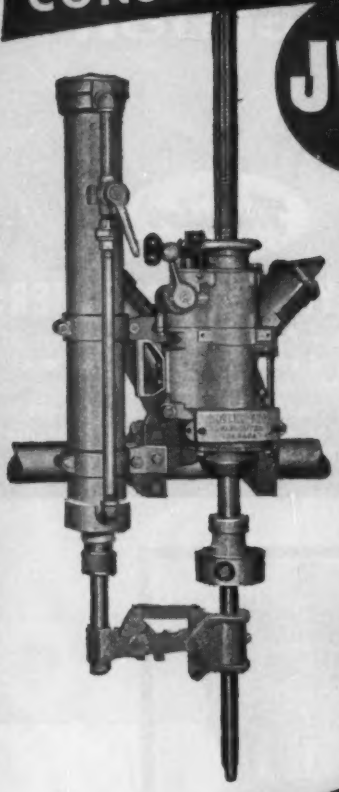
Piston motor or Vane motor

You Decide!

MAXIMUM POWER-MINIMUM AIR CONSUMPTION



JVR

New reversible version of the world famous JV underground drill. Delivers the same power, speed and dependability. Piston motor excels in high torque characteristics over entire speed range. New JVR features include adding of rods by drill power with reversible motor, right-hand threaded feed screw, rod adapter and built-in waterswivel —features which greatly increase both blasthole and coring footage over conventional drills requiring manual rod handling. Standard chuck assembly optional. Net weight range: 270 to 475 lbs.

MAXIMUM POWER-MINIMUM WEIGHT

VEG

New Vane motor powered version of JV. Outstanding feature is lightweight, compact construction. Drill can be speedily dismantled into two convenient units for ease of transportation. One man can readily move and set up. VEG has direct bevel gear drive to swivelhead, with optional ratios of 1.5 to 1, 2 to 1 and 3 to 1. Net weight range: 230 to 360 lbs.

JV, JVR & VEG Rated Coring Capacity

E - 800'	B - 450'
A - 600'	N - 350'

All above drills can be fitted with 3¼", 4½" (standard) or 5⅛" (piston diameter) rod puller.

WE LOOK INTO THE EARTH

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DRILLING COMPANY LTD.
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DRILLS • BITS • EQUIPMENT • CONTRACTING

The World's Most Complete Diamond Drilling Service

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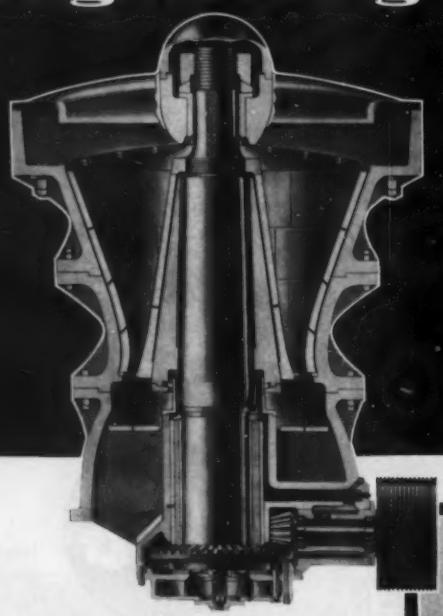
TRAYLOR-MADE

is engineering precision



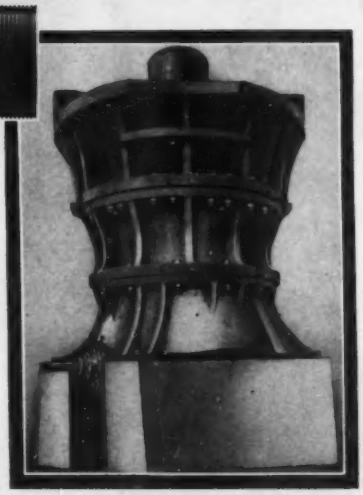
Traylor

TC GYRATORY CRUSHERS

. . . made in 7 sizes with feed openings 20" to 60" and capacities from 1,240 to over 32,000 tons per eight hour day are in use by many leading producers throughout the world. For specifications and capacities, send for Traylor Bulletin No. 1126.

Outstanding advantages of TC Gyratory Crushers:

- A straight line bar type spider, of heavy construction —simple but strong.
- Traylor original, self-tightening, bell head and curved concaves.
- A main shaft of minimum length, but of maximum diameter and strength.
- The Traylor patented dust seal. A practical and efficient device for excluding foreign matter from the lubrication chamber.
- A positive outside automatic lubrication system.
- A self-contained countershaft bearing, fitted with roller bearings and automatically lubricated.
- Bronze bushed eccentric bearing with pressurized lubrication.
- Machine cut steel gearing.



Your crushing problem is the personal business of the engineers at Traylor—with experience of more than 50 years in the crushing and grinding industry.

Traylor

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Sales Offices: New York — Chicago — San Francisco

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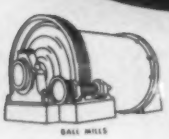


BALL MILLS

ROTARY KILNS

APRON FEEDERS

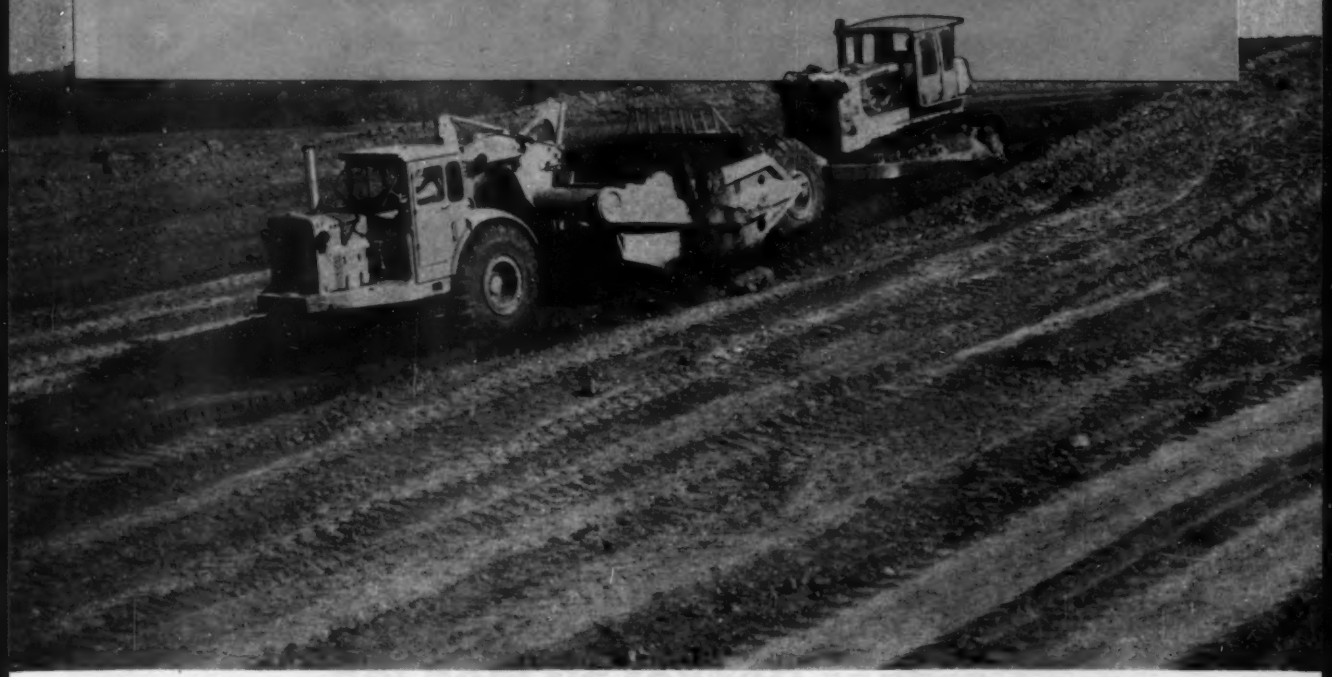
PRIMARY GYRATORY CRUSHERS

JAW CRUSHERS

SECONDARY GYRATORY CRUSHERS

On this stripping operation

CAT* DW21-NO. 470 RIGS ARE DELIVERING LOW-COST PRODUCTION



You see plenty of rugged Caterpillar-built machines at work on the Marquette Cement Company's stripping operation at Oglesby, Ill. In fact, you don't see any other make. That's the result of years of profitable experience, Superintendent W. T. Spurr will tell you.

The picture above shows one of the firm's seven big DW21s with No. 470 LOWBOWL Scrapers being push-loaded by a D9 Tractor. And it shows something else, too—how to move material at the lowest cost per yard.

These DW21-No. 470 rigs have capacities for big-volume hauling—18 cu. yd. struck, 25 cu. yd. heaped. But more important than capacity, the No. 470's LOWBOWL design has greater loading efficiency than *any other make* of scraper in its class. Actual tests show that the No. 470 gets its rated capacity load and is on its way while other scrapers are still in the cut struggling for the last few yards.

And when it has its big load, the DW21 moves it at high speeds, efficiently. Its 300 HP (maximum output) Cat-built Engine has a Turbocharger to add horsepower at reduced fuel costs. Air is packed into the engine *according to engine load*, not speed. Wide-section, tubeless, 29.5-29 tires provide excellent flotation and furnish greater tractive effort.

Let your Caterpillar Dealer show you how these rugged rigs can move material faster and cut costs on your operation. You can depend on him for sound advice now—for fast service and parts you can trust after you buy.

Caterpillar Tractor Co., San Francisco, Cal.; Peoria, Ill., U.S.A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

WANTED—
THE HARD WORK

Horizontal drilling with Air Feed Leg mounted sinker.

Less time to set up and tear down with Gardner-Denver air feed leg

Recommended to replace jumbos in smaller headings and inaccessible workings. No time wasted in setting up columns or crossbars. One man brings Air Feed Leg mounted drill into position and starts drilling.

- Adjustable feed leg pressure provides proper feeding in horizontal or up-hole drilling
- Controls conveniently located on backhead
- Push-button air release in feed leg
- Automatic water gland for water-on, air-on, air-off, water-off cycle
- Constant chuck-end blowing stops cuttings from entering drill
- Piston rod wiper excludes dirt
- Supports drill in rigid stoper bracket for up-hole drilling
- Drill easily removed for use as sinker

Model FL58
Air Feed Leg.

WRITE FOR BULLETIN

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois
Gardner-Denver Expert Division, 233 Broadway, New York 7, New York
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

Shovel clean-up is only one of many jobs Tournatractor handles at Festus, Mo. for Aubuchon Silica Mining Division of Portage-Manley Sand Co. Working in extremely abrasive sand, and across uneven hard rock floors, has been no problem and maintenance costs have been very low.

How Aubuchon keeps ahead of tight production schedules

. . . cuts costs on tractor maintenance

Pit shovel, to wash plant, to rail car — in an hour. That's a normal scheduling at Aubuchon Silica Mining Division, Festus, Mo., U.S.A. Owned by Portage-Manley Sand & Gravel Co., Rockton, Ill., the firm ships many carloads a week of fine silica used in foundry cores and crystal glass.

Aubuchon does no stockpiling, depends on steady production to fill orders. Extended downtime on any machine, therefore, could halt shipments. One of the major availability problems is that of the pit tractor. Servicing the stripping and clean-up operations over the entire pit and plant area, this machine must continuously cross rough, rocky areas... working in silica so fine and hard it's been described as "sharp as grinding compound".

"Tournatractor® only machine that can do our tractor work . . ."

Since 1952, Aubuchon Silica Mining's tractor jobs have been handled by a rubber-tired LeTourneau-Westinghouse Tournatractor. As Plant Manager Ira Kent says: "The abrasion, rough going, and back-and-forth travel is too rough for crawlers. Tournatractor is the *only* machine we've seen that can do our tractor work."

Tournatractor's main assignments at this pit are stripping overburden to expose new sandstone, and cleaning up around shovels. But its rubber-tired mounting, sealed anti-friction drive, speed and "go-anywhere" ability let it take on a full circuit of haul-road building and maintenance, stripping, shovel and general clean-up dozing at the pit, mill, and yards.

Maintenance now no problem

How has the Tournatractor withstood such difficult operating conditions? Let Manager Kent describe its performance: "The last crawler we had was junk inside of 11 months. We have worked our Tournatractor 45 hours a week for almost 5 years, on our rough hard rock floors with free silica sand all over, *with no real trouble.*

"Our one and only major repair expense in all that time has been replacement of the torque-converter oil-seal and bearings. We've never done anything to the engine . . . never broke an axle, chipped a gear, or had a single major thing go wrong!"

Ask for a demonstration

Tournatractor has minimized maintenance problems for Aubuchon Silica Mining, while doing a lot of work quickly, efficiently. Investigate now what it can do at *your* pit. Let us send you full facts and arrange for an on-the-job demonstration. No obligation!

Tournatractor has plenty of power to doze rocks too big for pit shovel. Big, rubber-tired machine also cleans up fast to let drilling crew set next charges earlier.

Stripping overburden, Tournatractor slot-dozes — using walls of slot as "natural sideboards". Method keeps dirt from spilling off edge of blade for bigger loads with same effort. "Fill-in" jobs like this keep Tournatractor busy the year 'round.

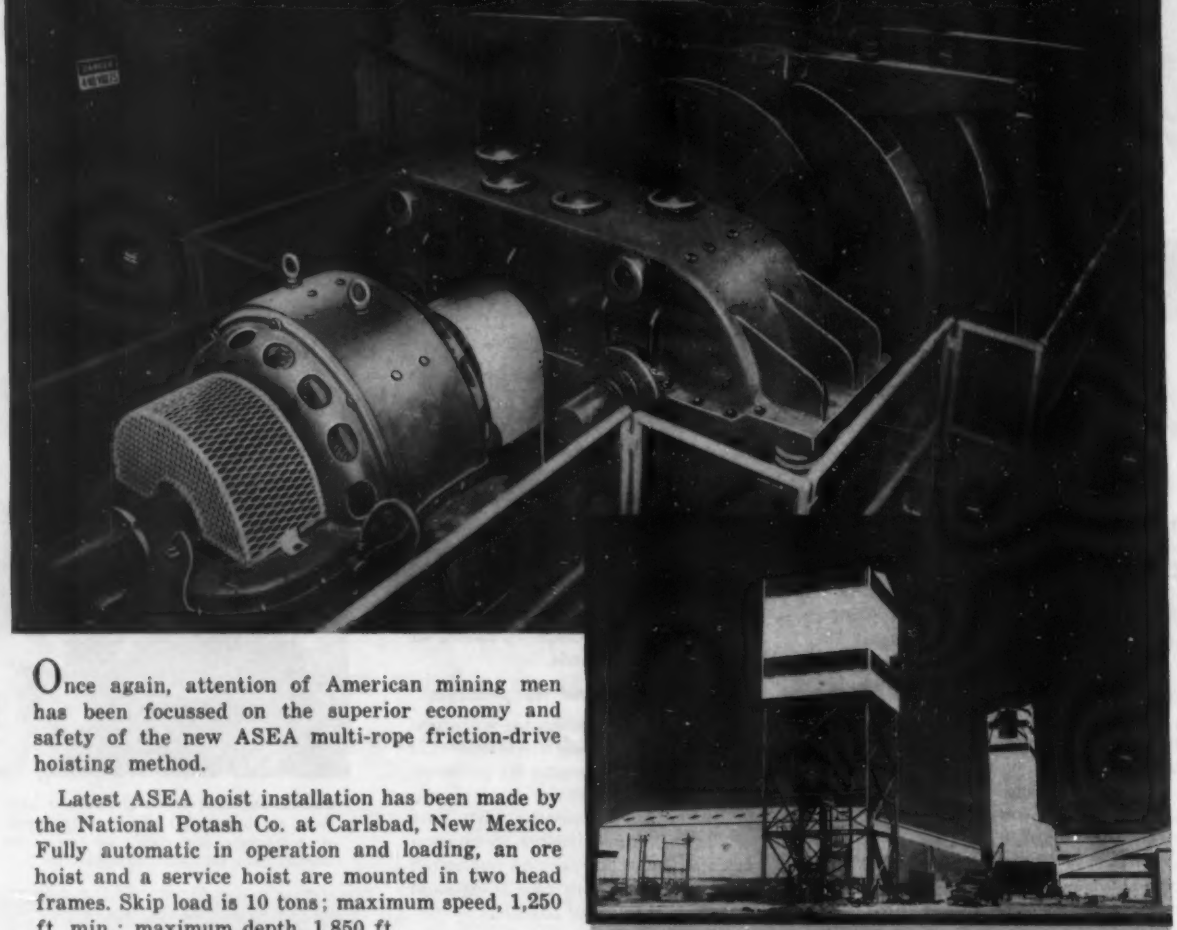
CT-1500-M-Ir

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

NEW ASEA MULTI-ROPE FRICTION HOISTS INSTALLED BY NATIONAL POTASH



Once again, attention of American mining men has been focussed on the superior economy and safety of the new ASEA multi-rope friction-drive hoisting method.

Latest ASEA hoist installation has been made by the National Potash Co. at Carlsbad, New Mexico. Fully automatic in operation and loading, an ore hoist and a service hoist are mounted in two head frames. Skip load is 10 tons; maximum speed, 1,250 ft. min.; maximum depth, 1,850 ft.

An ever-growing number of ASEA hoists is being installed throughout the U. S. and Canada.

You will want to look into these ASEA advantages:

COST LESS TO INSTALL AND OPERATE

1. Smaller diameter and narrow width of pulley give low unit weights and reduced inertia.
2. Compact size and low weight permits installation in head frame above shaft.
3. Above factors result in lower initial capital and operating cost.

SAFER

1. Several parallel ropes are used instead of a single rope.
2. Safety wedges on shaft guides positively prevent overwind.

SAVE ROPE WEAR

1. Less rope wear due to elimination of fleet angle, absence of S-bends, and elimination of cross-overs which are used in multilayer practice.

Illustrated booklets on ASEA mine hoists are available on request.

ASEA equipment is sold and serviced in the U. S. by:

AROS ELECTRIC, INC.

500 FIFTH AVENUE, NEW YORK 36, N. Y.

Can your haul units match these advantages?

Before you buy your next off-road hauling unit, make this test to see if you are getting the most for your money. Examine the various makes of haulers in the light of these features — standard on LeTourneau-Westinghouse Rear-Dumps:

Hauls anywhere — With big, low-pressure tires, L-W Rear-Dumps safely haul capacity loads over rutted haul-roads, paved highways, city streets . . . haul cross-country over rough terrain, over rocky pit floors . . . through mud, sand, and over soft fills.

Maneuvers easily — 180° turns — within distance of less than its own length — plus power-steer, quickly positions Rear-Dump under dipper. Time normally wasted by conventional haulers jockeying back and forth to spot at shovel or fill is eliminated. Big, square-type body target speeds loading.

Dumps fast, clean — Flick of an electric switch actuates hoist-motor. Body lifts quickly to any desired angle, for spreading on the run . . . or for dumping over bank. At full-dump position, bowl is behind rear wheels, so dump is clean, doesn't "bury" wheels. Streamlined body sheds material readily.

Cuts weather delays — Power-transfer differential automatically applies up to 80% of power to drive-wheel on firmest footing . . . pulls unit through mud, sand and soft materials which stop ordinary haulers. Front-wheel drive pulls unit off soft fills readily. Pivot-turn, through geared kingpin, "walks" prime-mover out of soft spots.

Provides maximum safety — Multi-disc air brakes have more wheel braking surface than any other type hauler. Low center of gravity, good visibility, power-steer, front-wheel drive, easy electric controls . . . all contribute to operator's confidence and safety.

Reduce maintenance — Having no hydraulics or jack-lines, no long drive-shaft . . . no frame, sub-frame, springs or tie-rods . . . these Tournapull® Rear-Dumps are less subject to downtime for maintenance and repairs than any other type hauler. Slant-bottom bowl reduces shock damage when loading large chunks.

Add to all these advantages, the versatility of Tournapull's prime-mover — which can be converted to operate these matching trail units: scraper, bottom-dump, flat-bed, logging arch, or crane. Any of these interchangeable work-units cost about 25% of your original machine investment. You benefit 100%.

Check all the "plus earning advantages" Tournapull Rear-Dumps have to offer YOU! Ask for complete details on the size that fits your needs: 11-ton "D", 22-ton "C", or big 35-ton "B", each a profit-maker.

R-1056-DC-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

starts purer than the shipping 'specs' for 'manufactured' soda ash...

but you pay no premium for the extra quality

It's a fact! Westvaco Soda Ash is low in iron and insoluble residues. Derived from natural sodium sesquicarbonate, it contains less sodium chloride and sodium sulfate to begin with than other finished soda ash, too.

And, in addition to exceptional chemical purity, Westvaco Soda Ash has unique physical properties as well. It disperses and dissolves quickly, flows freely and has fewer fines and less tendency to dust.

As a result Westvaco Soda Ash is easier to handle, cuts production costs and has other practical advantages in many soda ash applications.

We will be glad to send samples and quote on your needs to demonstrate that Westvaco superior quality costs you no more.

fmc®

Westvaco Chlor-Alkali Division

FOOD MACHINERY AND CHEMICAL CORPORATION

chemicals

161 E. 42nd St., New York 17 · Chicago St. Louis Denver Philadelphia So. Charleston, W. Va.

BECCO® peroxygen chemicals • FAIRFIELD® pesticide compounds • FMC® organic chemicals • NIAGARA® insecticides, fungicides and industrial sulphur • OHIO-APEX® plasticizers and resins • WESTVACO® alkalis, solvents, phosphates, barium and magnesium chemicals

How self-powered scrapers help cut mine operating costs

Tournapulls may be self-loaded, push-loaded, or shovel-loaded. The 9-yard "D" shown here hauls at speeds to 29.5 mph, unloads in seconds, makes complete turn in 26 feet. Simple electric controls and big 4-wheel air brakes permit rig to work safely at high speeds in lightly restricted quarters.

Read the following list of mine-scraper applications . . . analyze these scraper economies for your open pits:

1 In auxiliary stripping, where overburden is so thick that the wash or earth must be removed to allow boom-type equipment to work within its economical limits.

2 Where spoil room for boom-tool operations is inadequate; where outcrop is bothered by property lines, highways, railroads, pipe lines, power lines and undivertable streams.

Rigs make 180° turns, in less than machine's length, operate in tight quarters as shown above. Tournapulls keep working in tough going when other self-powered scrapers bog down. When one wheel slips, exclusive power-transfer differential automatically transfers power to wheel on firmest footing. Positive geared steer on kingpin pivots prime-mover from side to side, "walking" drive wheels to fresh footing.

3 Widening a bench at the side of the pit to provide greater casting area for shovel or dragline.

4 Stripping wet top-layers of earth, which might slough and cause slides into a shovel cut.

5 Cutting the initial box-cut, depositing the spoil out-of-the-way of later dragline operations.

6 Stripping or mining small or isolated veins that do not warrant the expense of moving large excavating equipment to the site.

7 Stripping hillside and hilltop operations...self-powered scrapers particularly adapted for this type of work.

8 Cutting new beds for temporary or permanent stream diversions; building dams and settling ponds.

9 Building grades for railroads and for truck haul-roads.

10 Construction and maintenance of ditch and drainage systems.

11 Grading around mine buildings and mine location housing.

12 Land-fill disposal of refuse.

13 Stockpiling of coal . . . spreads in even layers, compacts while hauling.

14 Supplementary hauling of ore, coal, or overburden...open-top scraper can be shovel-loaded and used as a truck-type hauler.

15 Mining lean ore, previously abandoned, in widely scattered or isolated areas.

16 Stripping overburden where level piling of spoil is required.

17 Stripping shallow overburden which does not justify expense of installing and operating major excavating equipment.

18 Leveling spoil piles for drainage, reforestation, farming, etc.

19 Removing and replacing top-soil for reclamation purposes.

If you have any of the above dirt-moving problems . . . write us or check with your nearest LeTourneau-Westinghouse Distributor. We will be glad to have our experienced field engineers analyze your operation and propose suitable procedure and equipment for most economical handling. Our rubber-tired prime-mover scraper combinations are available in three sizes: "D", 138 hp, 9 yards heaped capacity; "C", 210 hp, 18 yards heaped capacity; BIG "B", 293 hp, 27 yards heaped.

Tournapull—Trademark Reg. U.S. Pat. Off. P-1508-M-Ir

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

NORDBERG MACHINERY

...engineered for large volume, quality production of ores and industrial minerals

The entire line of heavy-duty Nordberg Mining Machinery has been engineered and built for one basic purpose . . . to meet the mining industry's expanding demand for low cost, quality production and processing of large tonnages of metallic and non-metallic ores and industrial minerals.

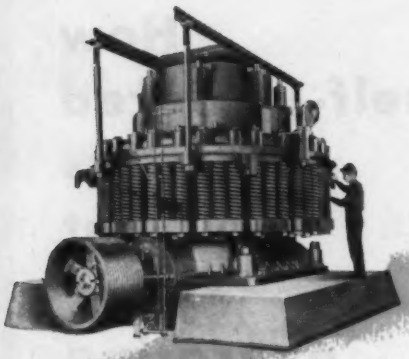
The many years of specialized experience gained by Nordberg in working closely with the mining fraternity has resulted in continual design and operational improvements which have consistently made Nordberg Machinery first choice among the world's leading ore and mineral producers.

As illustrated, Nordberg Mining Machinery includes Symons® Gyratory Crushers for primary breaking, Symons Cone Crushers for secondary and tertiary crushing, Nordberg Mills for wet or dry grinding, Symons Vibrating Grizzlies and Screens for scalping and sizing, and Nordberg Engines for mine and mill power.

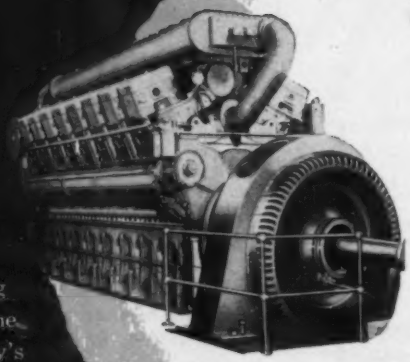
Write for literature on the Nordberg Machinery you need to efficiently produce large tonnages of ores and industrial minerals at lower cost per ton.

SYMONS . . . *A Registered Nordberg Trademark known throughout the world*

NORDBERG MFG. CO.
Milwaukee, Wisconsin



SYMONS CONE CRUSHERS
Built in both Standard and Short Head types, in sizes from 22" to 7' in diameter, in capacities from 6 to 900 or more tons per hour.



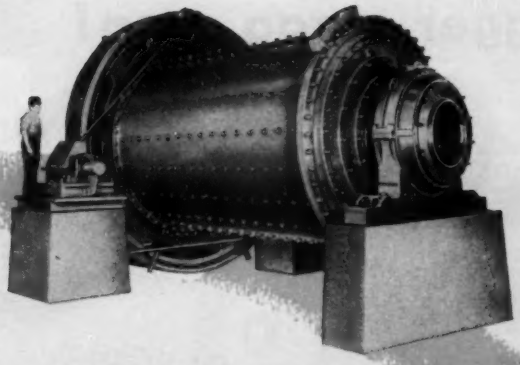
NORDBERG ENGINES
Ranging from small power units to large stationary engines. Nordberg engines are built in types for Diesel, Duafuel® and Spark-Ignition Gas operation, in sizes to over 12,000 horsepower.

SYMONS ROD DECK SCREENS
Highly efficient screening surface of spring steel rods—easily replaced. Especially suited for wet, sticky materials.

© 1957, Nordberg Mfg. Co.

SYMONS® PRIMARY GYRATORY CRUSHERS

Built in 30″, 42″, 48″, 54″, 60″ and 72″ feed opening sizes, for capacities to 3500 or more tons per hour.

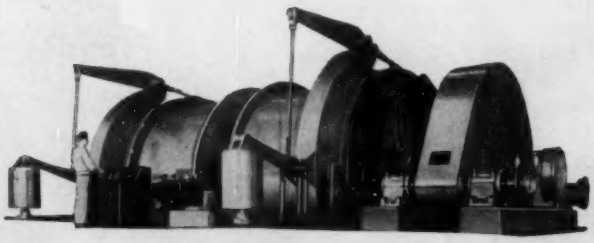


NORDBERG GRINDING MILLS

Built for wet or dry, open or closed circuit operation . . . including Rod, Ball, Pebble, Tube and Compartment types, in sizes from 6′ to 13′ dia., up to 50′ in length.

NORDBERG MINE HOISTS

Built in both friction and drum types for hoisting both ore and men. These dependable hoists are widely used in large coal and metal mining operations.

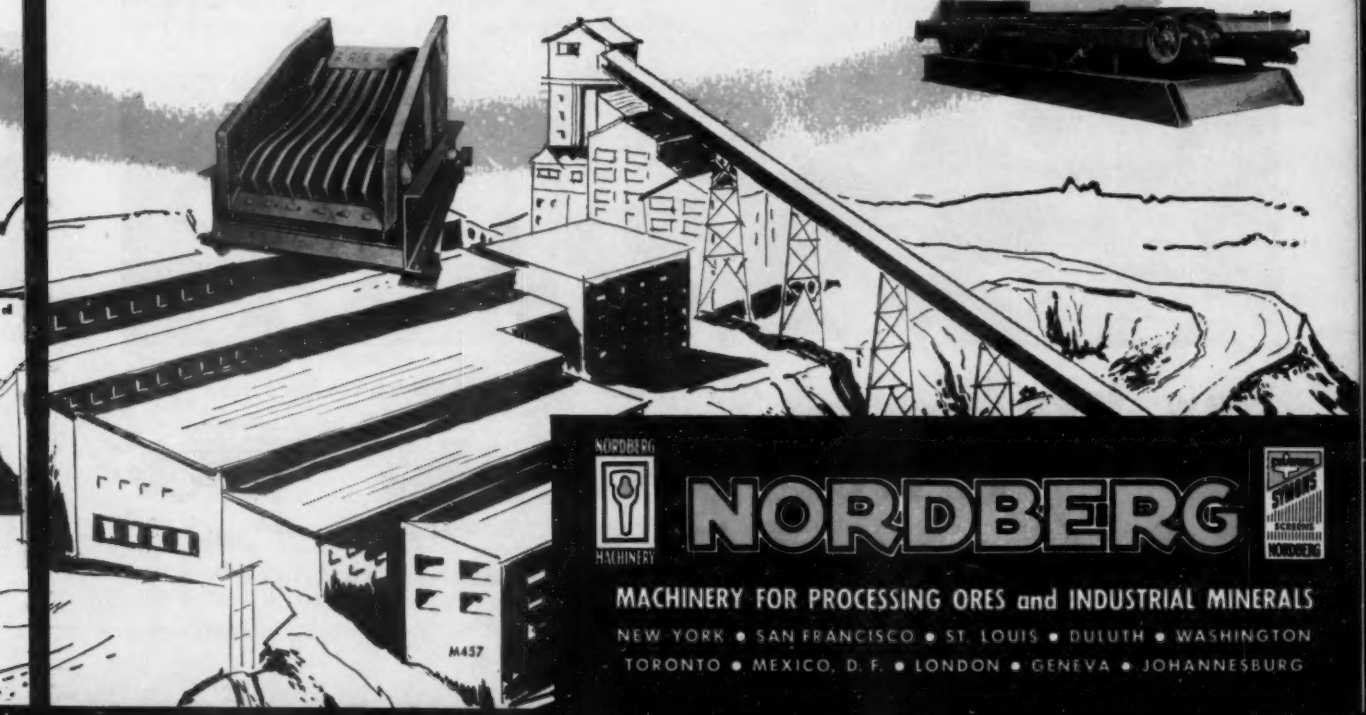


SYMONS VIBRATING BAR GRIZZLIES

Built for heavy duty large capacity primary scalping service. Particularly effective when handling wet, sticky or gummy ores.

SYMONS HORIZONTAL VIBRATING SCREENS

Permit level, large capacity screening of extreme accuracy. Built in single, double and triple deck types in a wide range of widths and lengths.



NORDBERG MACHINERY

NORDBERG

SYMONS SCREENS NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • ST. LOUIS • DULUTH • WASHINGTON
TORONTO • MEXICO, D. F. • LONDON • GENEVA • JOHANNESBURG

Bigger cargo area!

Another new and bigger Forward Control 'Jeep' Truck—the FC-170—puts a big 9-foot platform stake body on a wheelbase only 103½-inches long. This 7,000-pound GVW workhorse has room for 49 bales of hay, 35 bags of cement, or 60 bushel baskets. And the bed is only 35-inches from the ground for back-saving ease of loading!

"Go-anywhere" action!

The new 'Jeep' FC-170 Truck sets a new standard for "big-load" maneuverability. It delivers payloads of up to 3500-pounds to areas ordinary vehicles can't reach. The spacious Safety-View cab puts you in a "Forward Control" position—lets you maneuver on or off the road with greater command of any driving situation!

Tough-job traction!

The extra traction of FC-170 4-wheel drive, and its wide 63-inch tread, take you "almost anywhere" with ground-gripping stability. It shifts easily into conventional 2-wheel drive for highway travel. The high-torque Hurricane 6-226 engine delivers real working power at low cost. It's ready for your bigger, tougher jobs!

New 'Jeep' Forward Control 4-Wheel-Drive FC-170

Willys... world's largest manufacturers of 4-Wheel-Drive vehicles

...other members of the famous 'Jeep' family:

Forward Control 'Jeep' FC-150

Universal 'Jeep'

'Jeep' Utility Wagon

See 'Jeep' vehicles at your Willys dealer

NEW MACK

heavy-duty four- and six-wheel dumpers

15- to 34-ton capacity

* LARGEST SELECTION OF HEAVY DUMPERS

Mack offers you the most complete line of dumpers for mining, quarrying, road building, construction. From heavy-duty 170 horsepower, four-wheel dumpers with 15-ton capacities to super-duty 400-horsepower, six-wheel dumpers with 34-ton capacities, Mack provides the economy and performance that can mean bigger hauling profits for you.

* CHOICE OF ENGINES

Mack offers you a choice of engines . . . Cummins diesels in the 300- and 400-horsepower class . . . or Mack Thermodyne and Cummins diesels in the 170 to 205 horsepower class. No need to alter existing maintenance facilities to handle new engine makes . . . you get the truck you want with the engine you want.

* OUTSTANDING PERFORMANCE

When you buy Macks, you know that you are getting top performance, outstanding economy, maximum dependability—qualities that have made Mack the acknowledged heavy-duty truck leader in the industry. Moreover, Mack dumpers are planned for accessibility throughout . . . engines are easily reached, no place in the suspension ever needs adjustment—these and many more Mack features reduce maintenance costs and make routine servicing easier. And in Macks, you get the finest transmissions and axles available . . . made by Mack and found only in Macks!

* COMPETITIVELY PRICED

Mack off-highway dumpers are priced right in line with competitive makes. Yet, with Macks, you get those "extras" that mean more payloads at lower hauling costs . . . cabs engineered for maximum driver efficiency . . . specially designed components with extensive use of heat-treated alloy steels . . . single-unit all-welded frames that can take plenty of hard knocks . . . outstanding performance and economy from a complete line of engines.

* STOCK DELIVERY

All 15 and 22½-ton Mack dumpers are available from stock. The units you want with the engines and transmissions you want can be supplied upon gratifyingly short notice. There are no delays, no production schedules for you to worry about. For more information on delivery, contact your local Mack Dealer or Representative.

MACK LRX

capacity: 15 tons

This four-wheel, off-highway dumper combines a big 15-ton rated capacity with outstanding maneuverability. Either a Mack or Cummins Diesel engine —along with heavy-duty clutch, 10-speed transmission, and Mack's Planidrive rear axle assembly —gives plenty of pulling power for long hauls on steep grades. Rugged, unified frame assembly, powerful air brakes, and comfortable cab with driver's position offset to the left assure the top performance and efficiency that have made the LRX a highly popular dumper in mine, quarry, and road-building operations.

CONDENSED SPECIFICATIONS

STANDARD EQUIPMENT

DIMENSIONS:	14.00-24 Rear Tire
Wheel Base	13′ 4″
Platform	9′ 1″
Overall Width	9′ 11″
Overall Height	10′ 8″
Overall Height (Body Raised)	18′ 8″
Overall Length	24′ 7½″
Turning Circle Diam. (To outside edge of tire)	60′
Weight (Chassis, Body & Hoist)	33,000 lbs.
Payload	30,000 lbs.

ENGINE (Diesel):

Model	END 673
Make	Mack, Thermodyne
Type	Naturally aspirated
Number of cylinders	Six
Bore and stroke	4⅛″ x 6″
Piston displacement, cu. in.	672
Brake horsepower @ 2100 r.p.m. (gov.)	170
Max. torque @ 1200 r.p.m.	480 lb.-ft.

CLUTCH (Available with END 673 only):

Type	Mack single-plate, dry
Area of engagement, sq. in.	253

ELECTRICAL SYSTEM:

Voltage and capacity . 12 V., 50 Amp. (24 V., Starting)

TRANSMISSION:

Type	Mack selective, constant mesh
No. of speeds, forward	Ten
reverse	Two

FRONT AXLE:

Make . Mack Reversed-Elliott, drop-forged I-beam

REAR AXLE:

Make	Mack Planidrive
Drive	Dual Reduction
Final Drive (3rd reduction)	Planetary gear train within wheel hubs
Total Ratio	16.5

BRAKES (Air):

Compressor	Tu-Flo
Type	Internal expanding
Front, size	17¼″ x 5″ x ¾″
Rear, size	20″ x 7″ x ¾″
Hand, size	12″ x 5″ x ⅜″, Bendix

FRAME:

Side-members, size	12½″ x 6¼″ x ½″, wide flange I-beam, rolled section
Section modulus	60.7 (per rail)

SPRINGS:

Front, type	Semi-elliptic
Rear, suspension	Semi-rigid, axle mounted to frame

WHEELS:

Type . . . . . Cast, spoke

STEERING GEAR:

Control . . . . . Manual

TIRES:	Front	Rear
Size	12.00-24 (16P) Rib	14.00-24 (20P) Lug

CAB:

Type: Heavy-duty off-highway, closed, all-steel welded. Offset 10¾″ to left of chassis centerline provides clear vision for driver to rear.

CHASSIS EQUIPMENT: Front and rear tow pins; air horn on cab roof; cab entrance steps and platforms; rear view mirror, left side; channel type front bumper; dual windshield wipers; vertical exhaust; stop-tail light; rim lug wrench and handle.

HOIST:

Make & model . . . . . Heil
Type-Twin, double-acting, 8″ diameter, hydraulic cylinders with 24″ stroke, 70° dumping angle.

BODY:

Type	Rock, with scoop end
Make	Heil
Capacity, line of plate	9.8 cu. yds. struck

Construction: ¼″ steel plate shell bottom; ⅜″ sides and header; ½″ wear and side bevel plates; ¼″ canopy. 3″ x 5 lb. channels between floor plates either side of a 1⅛″ edge-grain hardwood middle section filler.

OPTIONAL EQUIPMENT

ENGINE (Diesel):

Model	NHB	ENDT 673
Make	Cummins	Mack, Thermodyne
Type	Naturally aspirated	Turbocharged
Number of cylinders	Six	Six
Bore and stroke	5½″ x 6″	4⅛″ x 6″
Piston displacement cu. in.	743	672
Brake horsepower @ 2100 r.p.m. (gov.)	200	205
Max. torque @ r.p.m.	1200	1400-1600
pound-feet	537	560

CLUTCH (Included with NHB and ENDT 673):

Type	Mack two-plate, dry
Area of engagement, sq. in.	416

TIRES:	Front	Rear
Size	13.00-24 (18P) Rib	16.00-25 (20P) Lug

BODY:

Type	Flared Quarry
Make	Heil
Capacity, line of plate	11 cu. yds. struck

Construction: ¼″ steel plate shell bottom; ½″ sides; ½″ header, slope; ⅝″ header, vertical; ½″ wear plate; ¼″ canopy. 3″ x 5 lb. channels between floor plates either side of a 1⅝″ edge-grain hardwood middle section filler.

Body Equipment: (for std. and opt. bodies)—(9) ¾″ x 6″ alloy wear bars; rock ejectors; ½″ alloy wear plate; horizontal bolsters (3 per side); canopy, loose for export shipment. (for std. body only): exhaust heating connections; welded-on side boards.

CHASSIS EQUIPMENT: Automatic radiator shutters; Wagner "BB" (24 hour chart 0-3500 r.p.m.) tachograph, in place of standard Tachometer; speedometer; hubodometer, left front wheel; Vickers power steering; front wheel limiting valve; hand control valve to operate rear service brakes; low air pressure indicator, Wig-Wag type; screen type radiator guard; 25,000 B.T.U. hot water cab heater with defrosters; spare rim; hydraulic jack, 20-ton; air starting; cold starting equipment; insulating dash mat.

MACK — FIRST

MACK LVX

capacity: 22½ tons

This four-wheel dumper with its 22½-ton rated capacity provides maximum payloads at minimum unit cost. Equipped with either a 300 or 335-horsepower engine, over-gear transmission with two-speed compound or torque converter, and Mack's exclusive Planidrive rear axle assembly, it is powered to give top performance under the most punishing operating conditions. All-welded, single-unit, alloy-steel frame gives LVX's stamina and rugged durability. Elbow steering column, hydraulic steering booster, two-plate air-assisted clutch, and job-engineered cab with extreme left driver position assure maximum operating efficiency. From top to bottom, this big Mack gives you the "extras" that mean minimum hauling costs.

CONDENSED SPECIFICATIONS

STANDARD EQUIPMENT

DIMENSIONS:

Wheelbase	14' 2"
Platform	9' 11"
Overall Width	11' 2"
Overall Height	11' 4⅝"
Overall Length	26' 7½"
Overall Height (Body Raised)	21'
Turning Circle Diam. (To outside edge of tire)	62'
Weight (chassis, body & hoist)	40,800 lbs.
Payload	45,000 lbs.

ENGINE (Diesel):

Model	NHRBIS
Make	Cummins
Type	Supercharged
Number of cylinders	Six
Bore and stroke	5⅛" x 6"
Piston displacement, cu. in.	743
Brake horsepower @ 2100 r.p.m. (gov.)	300
Max. torque @ 1500 r.p.m.	818 lb.-ft.

CLUTCH:

Type	Mack Two-plate, dry
Area of engagement, sq. in.	416
Actuation	Manual, with air assist

ELECTRICAL SYSTEM:
Voltage and capacity . 12 V., 50 Amp. (24 V. Starting)

TRANSMISSION:

Type	Mack selective, constant mesh
No. of speeds, forward	Eight
reverse	Two

FRONT AXLE:
Type . . . Mack Reversed-Elliott, drop-forged I-beam

REAR AXLE:

Make	Mack Planidrive
Drive	Dua' Reduction, spiral bevel
Final drive (3rd reduction)	Planetary gear train within wheel hubs
Total Ratio	17.66

BRAKES (Air):

Compressor	Tu-Flo
Type	Internal expanding
Front, size	17¼" x 5" x ¾"
Rear, size	18" x 10" x ¾"
Hand, size	12" x 5" x ⅜"

FRAME:

Type	I-beam, wide flange
Material	Alloy steel
Side-members, size	13¹¹⁄₁₆" x 8" x ⅝" (Fabricated)
Section modulus	74.8 per rail

SPRINGS:

Front	
Type	Semi-elliptic
Suspension	Mack rubber shock insulators
Rear	
Type	Progressive rate, semi-elliptic
Suspension	Cam face slipper ends with radius rods

TIRES:	Front	Rear
Size	14.00-24 (16P) Rib	18.00-25 (24P) Lug

WHEELS:
Type . . . . . Cast, spoke

STEERING GEAR:
Power steering assist . . . Vickers hydraulic booster

CAB:
Type . Heavy-duty off-highway, closed, all-steel, welded. Cab offset 10¾" to left of chassis centerline provides clear vision for driver to rear.

CHASSIS EQUIPMENT: Screen type radiator guard; front and rear tow pins; air horn on cab roof; dual windshield wipers; two air reservoirs; rear view mirror, left side; Mack power take-off and control (not available with Allison Transmission); door in hood side for access to oil filler and dip stick; exhaust through hood with inline muffler; channel type front bumper; stop-tail light; rim lug wrench and handle.

HOIST:
Type . . . Twin, double-acting, outboard mounted, three section telescopic cylinder assembly directly connected to body and chassis through a universal joint arrangement providing a 70° dumping angle.

BODY:

Type	Rock, with scoop end
Make	Heil
Capacity, line of plate	14.8 cu. yds. struck

Construction: ¼" steel plate shell bottom; ⅜" sides and header; ½" wear and side bevel plates; ¼" canopy. 3" x 7.1 lb. channels between floor plates either side of a 2" edge-grain hardwood middle section filler.

OPTIONAL EQUIPMENT

ENGINE:

Model	NRTO
Make & type	Cummins, turbocharged
Number of cylinders	Six
Bore and stroke	5½" x 6"
Piston displacement, cu. in.	743
Brake H.P. @ 2100 r.p.m. (gov.)	335
Max. torque @ 1500 r.p.m.	900 lb.-ft.

TRANSMISSIONS:
Westinghouse Converter and Mack 4-Speed Transmission. Clutch—2-plate, 17", air actuated.
Allison Torqmatic Converter and Allison Transmission.
Twin Disc Converter and Mack 4-Speed Transmission.

FRONT AXLE: Special Heavy-duty, Reversed-Elliott, Drop-Forged I-beam.

TIRES:	Front
Size	14.00-24 (20P) Rib

BODY:

Type	Flared Quarry
Make	Heil
Capacity, line of plate	15.2 cu. yds., struck

Construction: ¼" steel plate shell bottom; ½" sides; ⅜" header; ½" wear and side bevel plates; ¼" canopy. 3" x 7.1 lb. channels between floor plates either side of a 2" edge-grain hardwood middle section filler.

Body Equipment: (for std. and opt. bodies): (9) ¾" x 6" alloy wear bars; rock ejectors; horizontal bolsters (3 per side); canopy toe board; rock guards over tires; canopy, loose for export shipment. (for std. body): welded-on side boards; exhaust heating connections.

CHASSIS EQUIPMENT: Air starting, Ingersoll-Rand 9HP; Tachograph, Wagner "BB" (24 hour chart 0-3500 r.p.m.) in place of standard Tachometer; Wig-Wag low air pressure indicator; hand control valve to operate rear service brakes; front wheel brake limiting valve; 25,000 B.T.U. hot water cab heater with defrosters; windshield fan mounted on windshield header; hub-odometer; engine chrome cylinder liners and stellite inlet valve seats; insulating dash mat; fender to bumper treads; air operated radiator shutter; air operated Thermo-controlled radiator fan hub; speedometer; back-up light; hydraulic jack, 30-ton; spare rims.

MACK LRSW

capacity: 30 tons

Powered by either a 300 or 335-horsepower engine, this 30-ton, six-wheel dumper has what it takes for off-highway operation in mines, quarries and earth-moving projects. Smooth application of power to its balanced, four-wheel drive bogie is obtained by an air-assisted clutch and overgear transmission with two-speed compound or torque converter.

Convenient location of controls, angle steering column, hydraulic steering booster, and extreme left driver position give easy and efficient handling. Best materials, precision manufacture, and specially engineered components make the LRSW capable of withstanding the toughest 'round-the-clock hauling.

CONDENSED SPECIFICATIONS

STANDARD EQUIPMENT

DIMENSIONS:

Wheelbase	16′ 10″
Platform	14′ 11½″
Overall Width	11′ 2⅜″
Overall Height	11′ 6½″
Overall Length	29′ 2⅛″
Overall Height (Body Raised)	24′ 10″
Turning Circle Diam. (To outside edge of tire)	78′
Weight (chassis, body & hoist)	60,000 lbs.
Payload	60,000 lbs.

ENGINE (Diesel):

Model	NHRBIS
Make	Cummins
Type	Supercharged
Number of cylinders	6
Bore and stroke	5½″ x 6″
Piston displacement, cu. in.	743
Brake horsepower @ 2100 r.p.m. (gov.)	300
Max. torque @ 1500 r.p.m.	818 lb.-ft.

CLUTCH:

Type	Mack two-plate, dry
Area of engagement, sq. in.	416
Actuation	Manual, with air assist

ELECTRICAL SYSTEM:

Voltage and capacity	12 V., 50 Amp. with 24 V., starting

TRANSMISSION:

Type	Mack two-lever, Duplex
No. of speeds, forward	Eight
reverse	Two

FRONT AXLE:

Type . . . . Mack Reversed-Elliott, drop-forged I-beam

BOGIE:

Make	Mack Planidrive
Final drive, type	Four-wheel, planetary
Inter-axle differential, type	Mack concentric cam and plunger Power Divider
Carriers	Mack Dual Reduction
Total Ratio	18.18

BRAKES:

Type and actuation	Internal expanding, inclosed, air
Front, size	17¼″ x 5″ x ¾″
Rear, size	20″ x 7″ x ⅜″
Hand, size	12″ x 5″ x ⅜″

FRAME:

Type	I-beam, wide flange
Material	Alloy steel
Side-members, size	13 15/16″ x 8″ with ⅝″ web and top flange, ⅞″ bottom flange
Section modulus	84.5 per rail

SPRINGS:

Type, front	Semi-elliptic
rear	Semi-elliptic, inverted
Suspension, Mack	Rubber Shock Insulators

SHOCK ABSORBERS, FRONT:

Type . . . . Houdaille, hydraulic

TIRES (Lug):	**Front**	**Rear**
Size	14.00-24 (20P)	16.00-25 (20P)

WHEELS . . . . Cast, spoke

STEERING GEAR:

Power steering assist . . . Vickers hydraulic booster

CAB:

Type . . Heavy-duty off-highway, closed, all-steel, welded. Offset 10¼″ to left of chassis centerline provides clear vision for driver to rear.

CHASSIS EQUIPMENT: Hubodometer; screen type radiator guard; front and rear tow pins; air horn; rear view mirror, left side; exhaust through hood with in-line muffler; channel type front bumper; door in hood side for access to oil filler and dip stick; insulating dash mat; wig-wag low air pressure indicator; windshield wipers; stop and tail light; back up light; rim lug wrench and handle; automatic radiator shutters.

HOIST:

Make . . . . Heil

Type—Twin, double-acting, 10″ diameter, hydraulic cylinders with 40″ stroke, 70° dumping angle with power return.

BODY:

Make and type	Heil, Rock-scoop end
Capacity, line of plate	21 cu. yds.

Construction: ¼″ steel plate shell bottom; ⅜″ sides and header; ¾″ slope section; ⅜″ alloy wear and side bevel plates; ¼″ canopy. 3″ x 7.1 lb. channels between floor plates either side of a 2″ edge-grain hardwood middle section filler.

OPTIONAL EQUIPMENT

ENGINE:

Make and model	Cummins, NRTO
Number of cylinders	Six
Bore and stroke	5½″ x 6″
Piston Displacement cu. in.	743
Brake horsepower @ 2100 r.p.m. (gov.)	335
Max. torque @ 1500 r.p.m.	900 lb.-ft.
Turbocharger	Turbine, exhaust driven

TRANSMISSIONS:

Westinghouse Converter and Mack 4-Speed Transmission. Clutch—2-plate, 17″, air actuated.

Allison Torqmatic Converter and Allison Transmission.

WHEELS, TIRES:

Front & rear Wheels, type	Cast spoke
Tires, size	16.00-25
Ply-rating, front	20 or 24
rear	24

BODY EQUIPMENT: (9) ¾″ x 6″ alloy wear bars; 1″ alloy wear plate; rock ejectors; horizontal bolsters (4 per side); twin body prop; rock guards over tires; exhaust heating connections; canopy, loose (for export shipment).

CHASSIS EQUIPMENT: Air starting, Ingersoll-Rand 9HP; chrome cylinder liners and stellite inlet valve seats; air operated Thermo-controlled radiator fan hub; Tachograph, Wagner model "BB" (24 hour chart 0-3500 RPM) in place of standard Tachometer; speedometer; front wheel brake limiting valve; alcohol vaporizer; cab insulated; exhaust outlet under cab suitable for attachment to body for body heating; 25,000 B.T.U. hot water cab heater with defrosters; solex glass for windshield; windshield fan mounted on windshield header; fender to bumper steel treads; two stop-tail lights; 20-ton hydraulic jack; spare rim.

MACK — FIRST

MACK LRVSW

capacity: 34 tons

The 34-ton rated capacity of this super-payload, six-wheel dumper assures minimum haulage costs for the big earth-moving jobs. Equipped with a 400-horsepower engine, four-speed overgear transmission, hydraulic torque converter or two-speed compound, and a balanced, four-wheel drive bogie, LRVSW's can negotiate severe grades fully loaded. Maneuverability and ease of handling are facilitated by such features as a hydraulic steering booster and air-assisted clutch. Heat-treated, stress-proportioned, single-unit frame gives the structural stamina needed to withstand severest operating conditions. All these features, and many more, contribute to unmatched durability and minimum haulage costs.

CONDENSED SPECIFICATIONS

STANDARD EQUIPMENT

DIMENSIONS:

Wheelbase	16′ 10″
Platform	14′ 11½″
Overall Width	11′ 2⅜″
Overall Height	11′ 7⅝″
Overall Length	31′ 3⅛″
Overall Height (Body Raised)	25′ 2″
Turning Circle Diameter (To outside edge of tire)	78′
Weight (chassis, body & hoist)	68,000 lbs.
Payload	68,000 lbs.

ENGINE (Diesel):

Model	NVH-1200
Make	Cummins
Type	Naturally aspirated
Number of cylinders	12
Bore and stroke	5⅛″ x 6″
Piston displacement, cu. in.	1486
Brake horsepower @ 2100 r.p.m. (gov.)	400
Max. torque @ 1200 r.p.m.	1,075 lb.-ft.
Fuel tank and location	150 gal., back of cab

CLUTCH:

Make	Lipe Rollway
Type	Two-plate, dry
Area of engagement, sq. in.	571
Actuation	Air

ELECTRICAL SYSTEM:

Voltage and capacity	12 V., 75 Amp.
Generator, make and type	Leece-Neville, alternator

STARTING SYSTEM:

Starting motor, type	Air
Make	Bendix-Westinghouse
Rating, horsepower	25
Cold starting aid	Ether injection

TRANSMISSION:

Type	Mack selective constant mesh
No. of speeds, forward	Four
reverse	One

TORQUE CONVERTER:

Model	Westinghouse 18″
Type	Single stage, hydraulic

FRONT AXLE:
Type . . . . Mack Reversed-Elliott, drop-forged I-beam

BOGIE:

Make	Mack Planidrive
Final drive, type	Four wheel, planetary
Inter-axle Differential	Mack concentric cam and plunger type Power Divider
Carriers	Mack Dual Reduction
Total ratio	18.18

BRAKES:

Type and actuation	Internal expanding, inclosed, air
Front, size	17¼″ x 5″ x ¾″
Rear, size	20″ x 7″ x ¾″
Hand, size	12″ x 5″ x ⅜″

FRAME:

Type	I-beam, wide flange
Material	Alloy steel
Side-members, size	Depth 14¼″, flange width 8″, flange thickness 1″
Section modulus	130.0 per side

SPRINGS:

Type	Semi-elliptic
Suspension, Mack	Rubber Shock Insulators

SHOCK ABSORBERS, FRONT:
Type . . . . Houdaille, hydraulic

TIRES (Lug) Front and Rear:
Size 16.00-25 (20P)

WHEELS:
Type . . . . Cast, spoke

STEERING GEAR:

Type	Worm and roller
Power steering assist	Vickers hydraulic booster

CAB:
Type . . Heavy-duty off-highway, closed, all-steel, welded. Offset 10¾″ to left of chassis center-line provides clear vision for driver to rear.

CHASSIS EQUIPMENT: Screen type radiator guard; hubodometer; front and rear tow pins; air horn; rear view mirror, left side; dual exhaust through hood with inline mufflers; channel type front bumper; rim lug wrench and handle; door in hood side for access to oil filler and dip stick; insulating dash mat; windshield wipers; stop and tail light; back up light; automatic radiator shutters.

HOIST:

Make & Type	Heil, twin, double-acting, outboard mounted, four-section telescopic cylinder assembly directly connected to body and chassis through a universal joint arrangement to provide maximum flexibility.
Dumping angle	70°

BODY:

Make & Type	Heil Rock, scoop end
Capacity, line of plate	24 cu. yds. struck

Construction: ¼″ steel plate shell bottom; ⅜″ sides and header; ¾″ alloy wear and side bevel plates; ½″ front slope plate; ¼″ canopy. 3″ x 7.1 lb. channels between floor plates either side of a 2″ edge-grain hardwood middle section filler

OPTIONAL EQUIPMENT

TRANSMISSION (In place of 4-Speed and Westinghouse Converter):

Make & Type	Mack Two-Lever, Duplex
Speeds Forward	8
Speeds Reverse	2

TIRES (Lug) Front and Rear:
Size 16.00-25 (24P)

BODY EQUIPMENT: (9) ¾″ x 6″ wear bars over standard ¾″ alloy wear plate; 1″ alloy wear plate in place of ¾″ alloy wear plate; exhaust heating; rock ejectors; rock guards over tires; twin body prop; horizontal bolsters (5 per side).

CHASSIS EQUIPMENT: Air operated Thermo-controlled radiator fan hub; Tachograph, Wagner model "BB" (24 hour chart 0-3500RPM) in place of standard Tachometer; speedometer; front wheel brake limiting valve; alcohol vaporizer; 25,000 B.T.U. hot water cab heater with defrosters; solex glass for windshield; windshield fan mounted on windshield header; fender to bumper steel treads; cab insulated; two stop-tail lights; spare rim; 20-ton hydraulic jack.

only MACK gives you features like these...

MACK-BUILT FRONT AXLES

Mack's reversed Elliott, drop-forged I-beam front axles are made extra strong for long, trouble-free service. Extensive use of heat-treated steels for crucial parts means minimum maintenance. Straight tie rod and rugged construction of air-actuated brake shoes insure top performance.

MACK-BUILT 2-WHEEL REAR AXLES

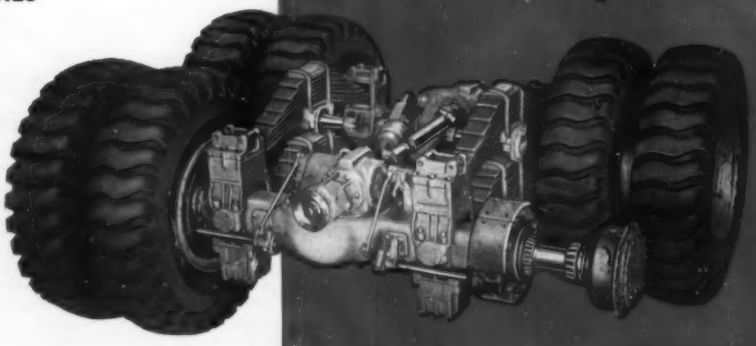
Mack's two-wheel, rear axle assemblies have an unmatched reputation for durability under strenuous service. The strongest, most wear-resistant materials are used throughout. Dual Reduction, gear-type differential and Mack's famous planetary gear reduction at the wheel hubs (Planidrive) provide the smooth distribution of power needed for top truck performance. Planetary gears can be serviced or repaired without removing tires or disturbing wheel bearing adjustment.

MACK-BUILT TRANSMISSIONS

Dependable performance and long life are standard in Mack transmissions. Shown here is the heavy-duty overgear transmission used for the LRVSW, LRSW, and LVX off-highway dumpers. The four-speed main transmission and two-speed compound are assembled as a unit to give eight forward and two reverse speeds. The four-speed main transmission without the two-speed compound is offered in combination with torque converter. All gears use Mack tetrapoid or quadrapoid tooth design and are drop-forged and case-hardened . . . gears noted for lasting the life of the truck.

MACK-BUILT 4-WHEEL BALANCED BOGIES WITH EXCLUSIVE POWER DIVIDER

Under the worst conditions of mud, loose gravel, or difficult terrain, you get maximum pulling power with Mack's four-wheel drive Balanced Bogies because exclusive Mack Power Dividers apply power to the wheels with traction. Planidrive final reduction gears in all four hubs provide needed reduction without excessively large carriers, differentials, or axle shafts. Maintenance is reduced to a minimum.



MACK first name for TRUCKS

Mack Trucks, Inc., Plainfield, New Jersey • In Canada: Mack Trucks of Canada, Ltd.

Mining Firm Cuts Drilling Cost up to 34% With a Bucyrus-Erie 50-R

Rate of Penetration in Taconite Formations Is Four Times the Rate of Cable Tool Drills

In 1953, a mining company began extensive tests on the Mesabi Range to determine the feasibility of rotary blast hole drilling in taconite.

At the end of this initial test work, the following conclusions were reached: 1.) Rotary drilling was feasible on the Mesabi Range. 2.) Larger rotary bit sizes held promise for better bit life. 3.) It would be necessary to change over from a smaller rotary drill to a Bucyrus-Erie 50-R to accommodate bits up to 12¼-in. diameter.

By the end of 1956, some 112,250 feet had been drilled, half of it through hard or medium-hard taconite. Reductions in costs ranged up to 34% compared with cable tool rigs.

Among the features that contribute to the 50-R's fine performance on the Range are the following: Using compressed air to cool the bit and clean out cuttings, the need for water is removed — especially important during cold weather. Heavies pile up adjacent to the hole, providing handy, excellent stemming material and permitting dry sampling. A remote-controlled, power-driven drill pipe rack minimizes manual effort. Hydraulically powered down pressure on the bit provides controlled load on drilling tools for maximum penetration. And Ward Leonard electric control on rotation of the drill pipe permits drilling at the most efficient speed for a given formation.

Two Bucyrus-Erie rotaries are available — the 40-R for drilling 6¾- to 9-in. holes, the 50-R for drilling 9⅞- to 12¼-in. holes. Get all the facts on these drills today.

60B57C

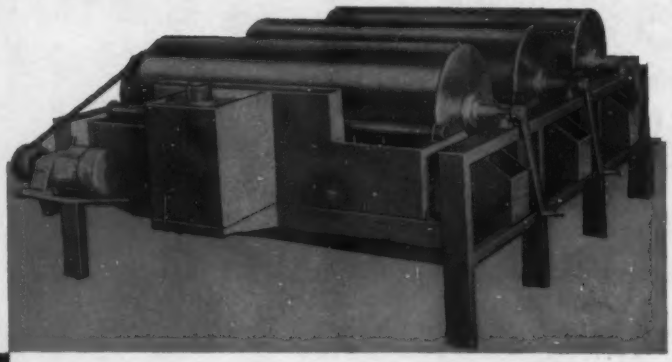
BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN

The well known

now of improved design.

Thune-Sydvaranger
PERMANENT MAGNETIC SEPERATOR



New features: Stainless nonmagnetic steel box, improved pulp distributor chamber eliminating feed shock troubles. New design is based entirely on the wellproved model used at Sydvaranger and Grängesberg and many other models in- and outside Scandinavia.

THUNE

users:

A/S Titania, *Norway*
A/S Sydvaranger, *Norway*
Luossavaara-Kirunavaara AB, *Sweden*
Stora Kopparberg Bergslags AB, *Sweden*
Trafik AB Grängesberg-Oxelösund, *Sweden*
Societa Mineraria Siderurgica Ferromin, *Italy*
Minas de Vila Cova, *Portugal*
and several smaller plants in Scandinavia.

In actual operations with old model have we attained up to 99 % purity (normaly above 97 %) and 70 % solids in the concentrate. New model has shown equal or slightly better results and is easier to operate.

Our firm also delivers electro-magnetic equipment like:
lifting magnets, pulleys, separator drums, clutches.

THUNE MEK. VÆRKSTED
OSLO - NORWAY

When Ordering Engine-Powered Equipment Up to 20 BHP... Be Sure to Specify American MARC Diesel Engines

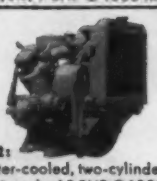
AMERICA'S LARGEST MANUFACTURER OF AIR-COOLED DIESELS PRESENTS

THE BIG 4 IN DIESEL POWER

AC1: Air-cooled, one-cylinder, 4-cycle, 6.5 BHP @ 1800 RPM

AC2: Air-cooled, two-cylinder, 4-cycle, v-type, 14 BHP @ 1800 RPM

WC1: Water-cooled, one-cylinder, 4-cycle, 7 BHP @ 1800 RPM



WC2: Water-cooled, two-cylinder, v-type, 4-cycle, 15 BHP @ 1800 RPM

A1Q Generating Plant: 3KW generator quill-mounted to American MARC air-cooled Model AC1. This and the Model A2Q Generator (5 KW) are ideal all-weather plants for marine, industrial, and rural electrical service.

AMERICAN MARC INC. dominates the field of lightweight, low-horsepower Diesels by building its diversified line from the "Big Four" basic models illustrated here. Purchase and maintenance of engines and parts are simplified by the use of these compact and rugged prime movers. All four types of American MARC Engines are employed daily by thousands of satisfied customers in industrial, agricultural, petroleum or marine fields.

AMERICAN MARC'S COMPLETE UNITS

Complete units for many purposes are also manufactured by American MARC—Diesel generating plants from 3 to 10 KW (AC or DC, and industrial three-phase), Diesel pumping units from 48 to 1700 GPM, marine propulsion, refrigeration units and power-packages for other services. American MARC can adapt any of its Big 4 engines to fit any job requiring from 6.5 to 20 BHP.

6-103

AMERICAN MARC INC.

1601 WEST FLORENCE AVE. INGLEWOOD, CALIFORNIA

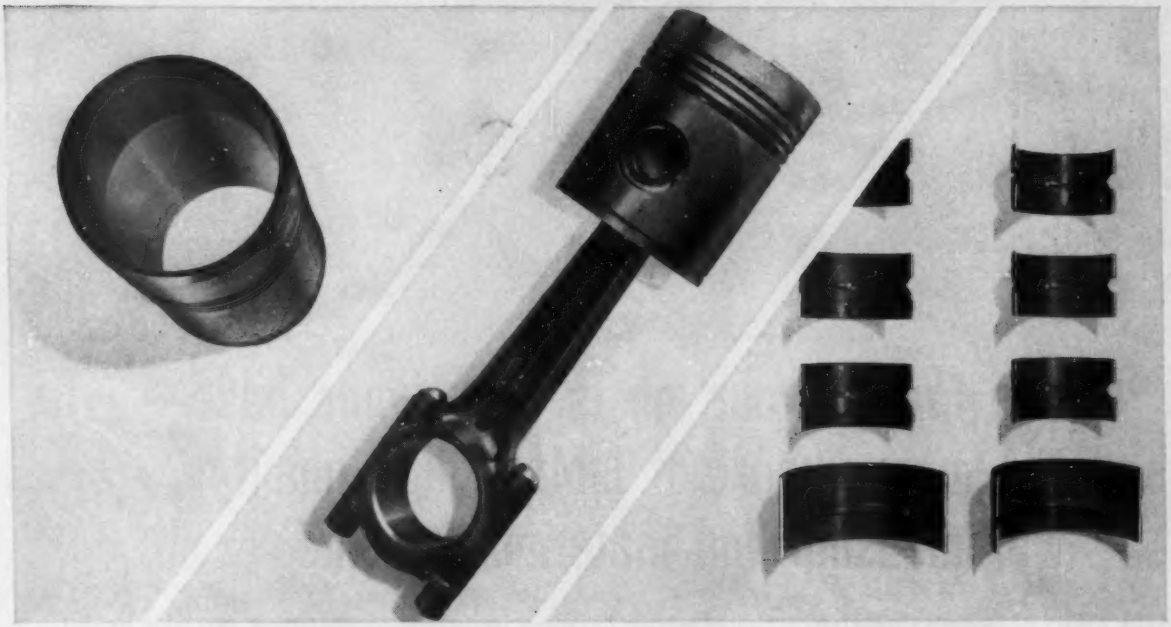
Dept. MW-107

INQUIRIES ARE INVITED FROM QUALIFIED DISTRIBUTORS AND DEALERS.

The Engineer's Field Report

CASE HISTORY
LUBRICANT RPM Delo Oils
FIRM Progressive Transportation Co, Compton, California

RPM DELO holds piston wear to .001" after 201,253 miles of on-and-off highway hauling



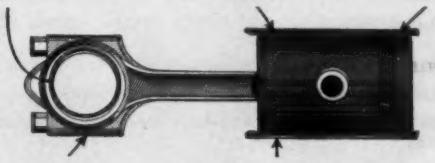
LUBRICATED WITH RPM DELO Oil, these engine parts were pulled from a Cummins HR diesel after 201,253 miles. A portion of this mileage was put on during four months of rugged service spotting loads of heavy pipe in the Arizona desert. When the engine was taken down, after two years of this on- and off-highway hauling, Progressive Transportation Co. found RPM DELO Oil had kept lacquer, gum, sludge, and deposits from forming...rod bearing wear varied between .0005 and .001 inch and pistons showed maximum wear of only .001". No wear at all evident on main bearings. Progressive Transportation uses RPM DELO Oils in all its large fleet of tractors—some of which have traveled well over 200,000 miles without overhaul.

Why RPM DELO Oils prolong engine life

Special compounds stop corrosion

Anti-oxidant resists lacquer formation

Detergent keeps all parts clean



Metal-adhesion qualities keep oil on parts in running or idle engines—inhibitor resists foaming

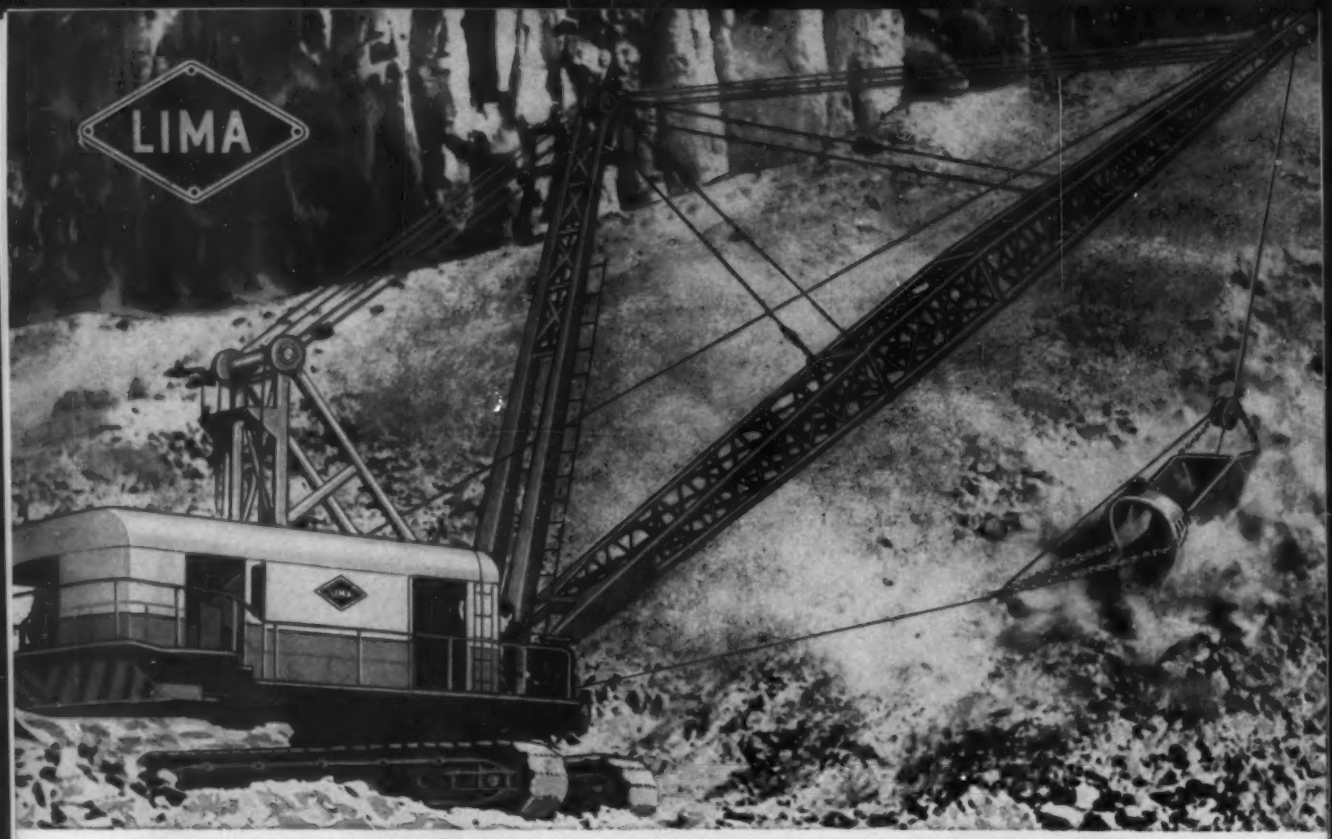
LUBRICATING OILS RPM DELO

For More Information... about this or other petroleum products of any kind, or the name of your nearest distributor, write or call any of the companies below.

STANDARD OIL COMPANY OF CALIFORNIA, 225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY, P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS P. O. Box 862 • El Paso, Texas



Lima Type 2400 Dragline working on refinery project in Aden. It's one of more than 50 Limas used by George Wimpey & Co., Ltd., of London, England, in its diversified, world-wide operations.

The farther your job is from home base—the more important LIMA'S high quality workmanship and materials become

The ability of Limas to withstand the most severe operating conditions puts them far out in front in all corners of the world. And the farther your job is from home base, the more important Lima ruggedness becomes. That's why cost-conscious contractors like George Wimpey & Co., Ltd., with giant projects in many parts of the world, count on Limas for high production with minimum downtime.

Here are some of the reasons why Limas do more and therefore cost less: Extra large capacity drums and sheaves lengthen cable life by reducing need for double wrapping and sharp bends; tread, idler and drive rollers are completely protected by dirt seals and retainers; anti-friction bearings cut friction losses, reduce wear, promote smooth operation; full air controls on larger models permit precision maneuvering, lessen operator fatigue, lower maintenance costs; all gears, shafts and parts which are subjected to extra wear are flame or induction hardened for longer life.

Lima agents are located in all parts of the world. Let them assist you in selecting the proper equipment for your job—and you can count on them for prompt and efficient service whenever you need it.

LIMA SHOVELS are available in capacities from ½ to 6 cu. yds.

LIMA CRANES are available in sizes to 110 tons capacity.

LIMA DRAGLINES are available in variable capacities to meet specific needs.

THE LIMA ROADPACKER—for low-cost, high-density compaction using the vibratory method.

LIMA AUSTIN-WESTERN CRUSHERS—Stationary and portable for high tonnages of aggregate in accurately controlled sizes.

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LIMA SHOVELS • CRANES
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BALDWIN BLH LIMA-HAMILTON

BALDWIN-LIMA-HAMILTON
Construction Equipment Division — LIMA WORKS

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Hamilton • Lewy-Hydropress • Madsen • Pelton • Standard Steel Works

WILLISON
automatic
COUPLERS

for safety, speed, strength

If your operation involves haulage with locomotives and cars in the 1 to 30-ton range, it will pay you to investigate the advantages of Willison Automatic Couplers.

Willisons are *Safer*—because they couple automatically...*Faster*—because they're self-aligning...*Stronger*—because they take the full buff and pull forces without depending on intermediate parts.

Over 100,000 Willison Automatic Couplers are in daily use in mines, industrial plants and foreign railroad service because they're *safer...faster...stronger.*

AA-5668

NATIONAL MALLEABLE and STEEL **CASTINGS COMPANY**

Established 1868 — Cleveland 6, Ohio

Canadian Subsidiary
NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY OF CANADA, LTD.
128 Simcoe St., Toronto 1, Ontario

WILLISON AUTOMATIC COUPLERS • RUBBER CUSHIONED UNITS
MINE AND INDUSTRIAL CAR TRUCKS • NACO STEEL WHEELS
NACO STEEL LINKS AND SWIVEL HITCHINGS

New Phosphoric Acid Plant for Norway

Dorr-Oliver Designed-Engineered-Equipped Plant
Attains Operating Capacity of 60 TPD of P_2O_5 in Two Weeks

The Norske Zinkkompani A/S Superphosphate Factory at Eitrheim near Odda, Norway.

Europe's newest phosphoric acid producer, the Norske Zinkkompani A/S, of Odda, Norway, recently went on stream producing 60 TPD of P_2O_5. One of the largest in the European fertilizer field, this new fully automatic plant attained operating capacity in two weeks, and is operated by only three operators per shift. The plant was designed by D-O's Consulting Engineering Dept., Stamford, Conn.; and by taking advantage of favorable world-wide prices, the necessary plant equipment was supplied from D-O Associate Companies in London, Milan and Amsterdam.

Dorr-Oliver's Consulting Engineering Department, with 40 years' experience in the field of concentrated fertilizer production via the wet process of manufacturing phosphoric acid, is staffed by engineers qualified to handle all phases of fertilizer plant design — from economic analysis to supervision of initial operation.

Close-up view of the Dorr-Oliver Traveling Pan Filter with the D-O designed graphic control panel in the background.

If you're considering entering the fast growing fertilizer field — or if you plan to expand present plant facilities — it will pay you to check with Dorr-Oliver. Write for Bulletin #8000, or better still, let us send an engineer to discuss your problem from the standpoint of economics and process. No obligation, of course.

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U. S. A.

"IN CASE OF EMERGENCY"

Mine emergencies happen without warning . . . and when they do happen, equipment that carries the "in case of emergency" label suddenly becomes vital to fire fighting and rescue efforts. Breathing protection devices are a major part of emergency mine equipment.

Below is a check list of this equipment offered by MSA. If you would like to make sure your emergency program is up-to-date, why not have our representative check your requirements and suggest a regular inspection and maintenance schedule.

M-S-A McCAA® Oxygen Breathing Apparatus—
gives complete breathing protection in any unbreathable atmosphere for a minimum of two hours. Used under the hardest physical conditions . . . in fighting and sealing fires, re-establishing ventilation, and rescue operations. U. S. Bureau of Mines approved.

M-S-A Chemox®—
allows complete breathing protection in any gaseous or oxygen deficient area for a minimum of 45 minutes. Generates its own oxygen supply from replaceable canister. Weighs only 13½ lbs. U. S. Bureau of Mines approved.

M-S-A All-Service Mask®—
assures safe, comfortable breathing protection against smoke and toxic gases including carbon monoxide—singly—or in combination where there is sufficient oxygen to sustain life. U. S. Bureau of Mines approved.

M-S-A Self-Rescuer®—
a miniature mask for use in deadly carbon monoxide following fire or explosion. Gives the miner precious minutes of emergency breathing protection. Unit is compact, lightweight; may be stored in quantity underground or carried individually. U. S. Bureau of Mines approved.

M-S-A Air and O_2 Mask—
designed for 30 minutes maximum breathing protection in any atmosphere—supplies air or oxygen in exact accordance with breathing requirements. Flow ceases during exhalation for added economy. Comfortable to wear and easy to use.

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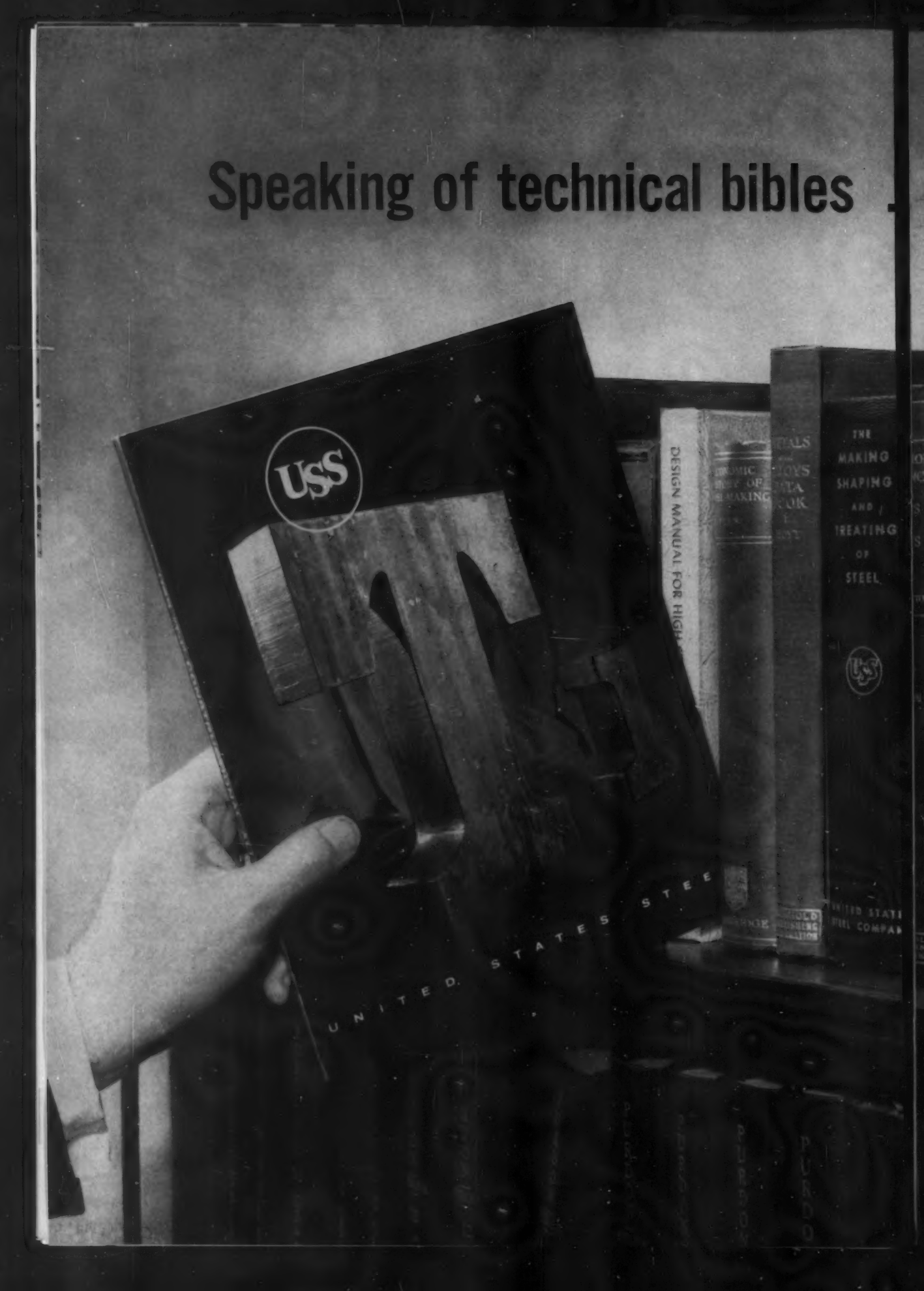

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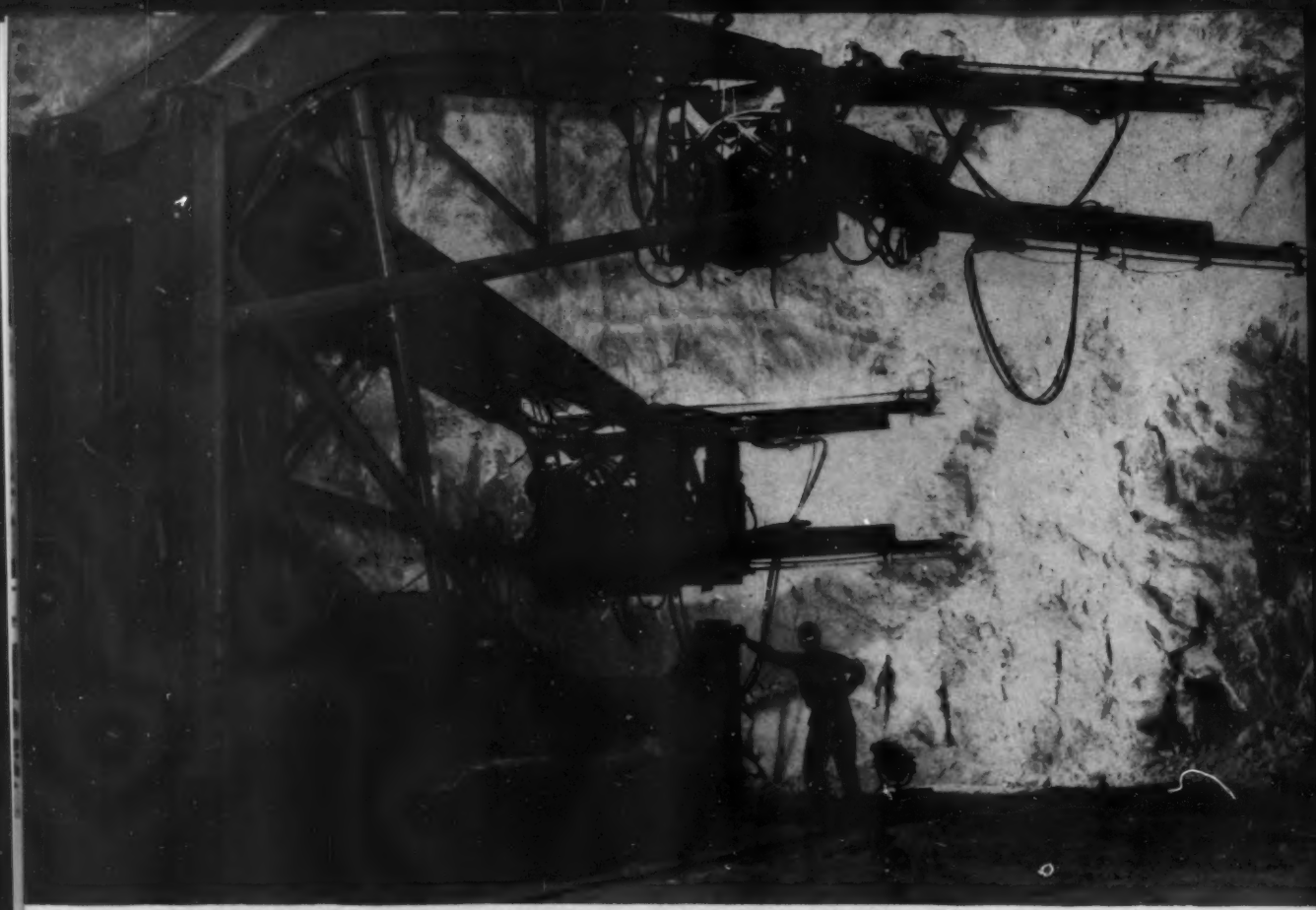

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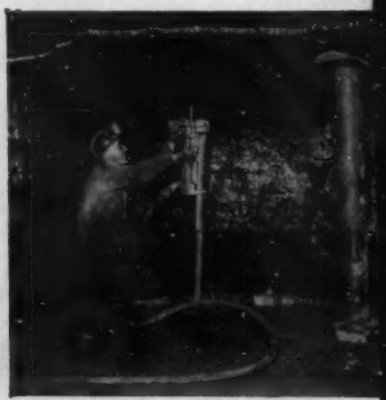

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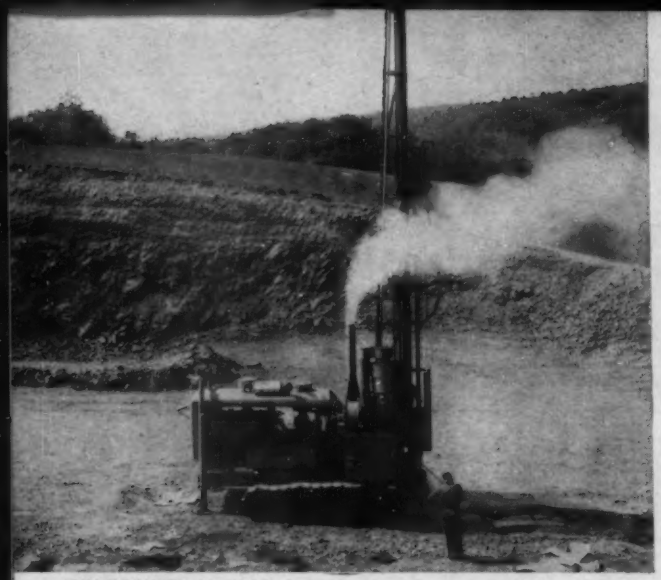

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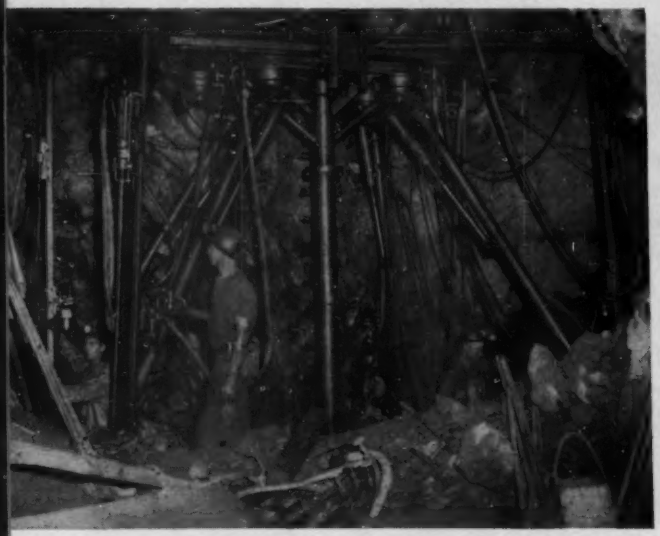

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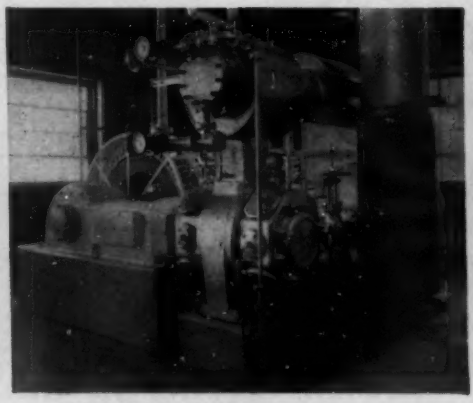

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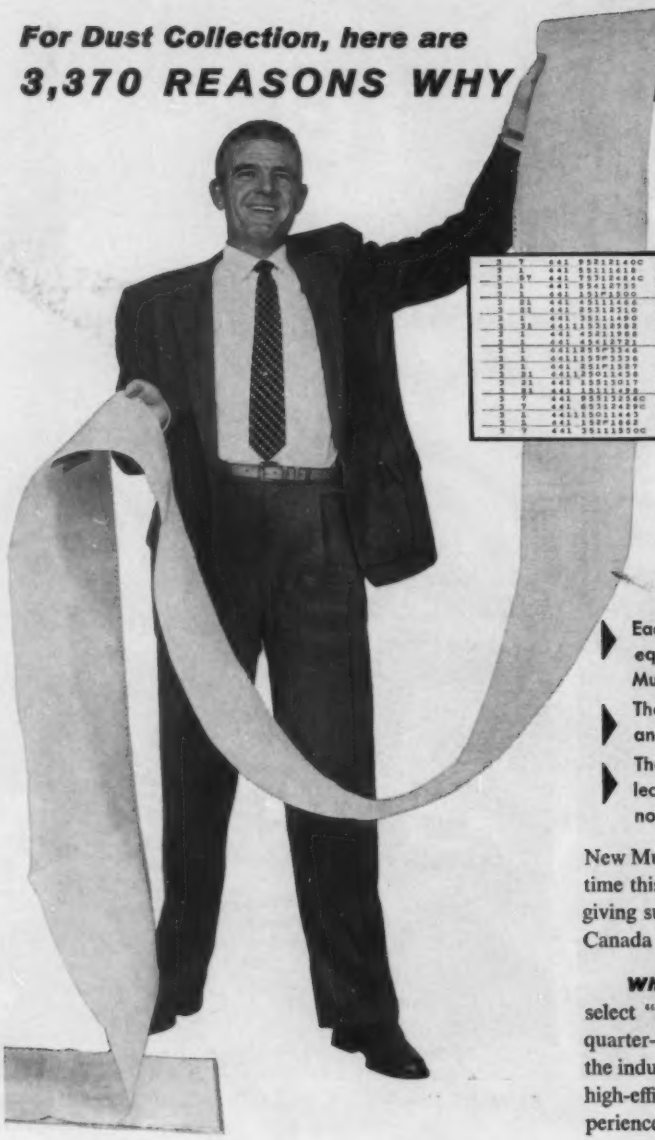

The tabulation sheet shown here is over 40 feet long, filled top to bottom with single-spaced typewriter listings as in the enlarged section above...

- Each typewritten line tabulates an installation of Multiclone equipment—an installation of from one to nine separate Multiclone units!
- These installations have been made in all parts of the world and in plants operating under widely-varying conditions.
- They include installations on virtually every type of dust collection problem—cement, non-metallic minerals, ferrous and non-ferrous metals, chemicals and many others.

New Multiclone installations are being made every day, but at the time this tabulation was made there were 3,370 Multiclone units giving superior service to industry throughout the United States, Canada and other countries.

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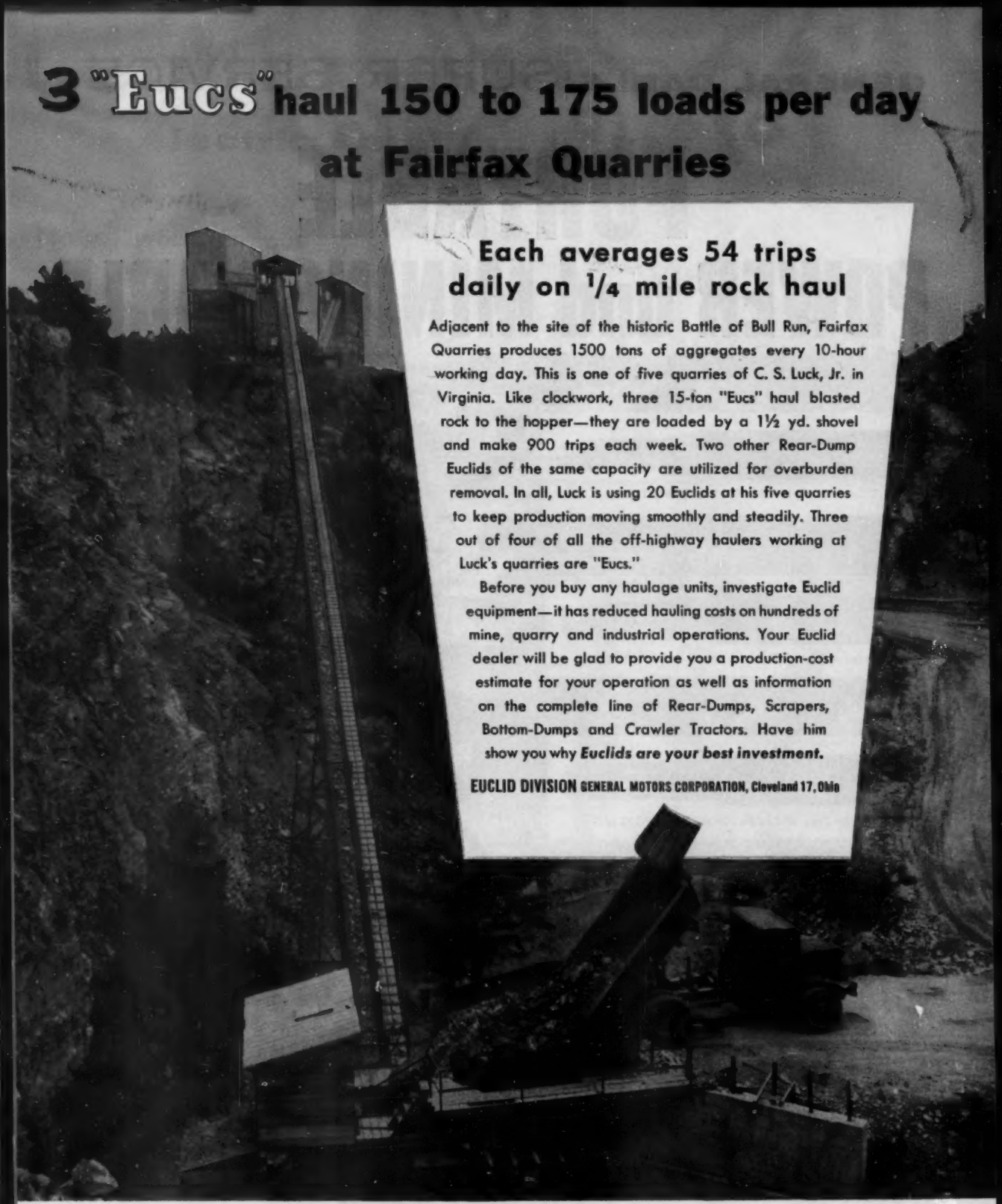
3 "Eucs" haul 150 to 175 loads per day at Fairfax Quarries



Each averages 54 trips daily on 1/4 mile rock haul

Adjacent to the site of the historic Battle of Bull Run, Fairfax Quarries produces 1500 tons of aggregates every 10-hour working day. This is one of five quarries of C. S. Luck, Jr. in Virginia. Like clockwork, three 15-ton "Eucs" haul blasted rock to the hopper—they are loaded by a 1½ yd. shovel and make 900 trips each week. Two other Rear-Dump Euclids of the same capacity are utilized for overburden removal. In all, Luck is using 20 Euclids at his five quarries to keep production moving smoothly and steadily. Three out of four of all the off-highway haulers working at Luck's quarries are "Eucs."

Before you buy any haulage units, investigate Euclid equipment—it has reduced hauling costs on hundreds of mine, quarry and industrial operations. Your Euclid dealer will be glad to provide you a production-cost estimate for your operation as well as information on the complete line of Rear-Dumps, Scrapers, Bottom-Dumps and Crawler Tractors. Have him show you why ***Euclids are your best investment.***

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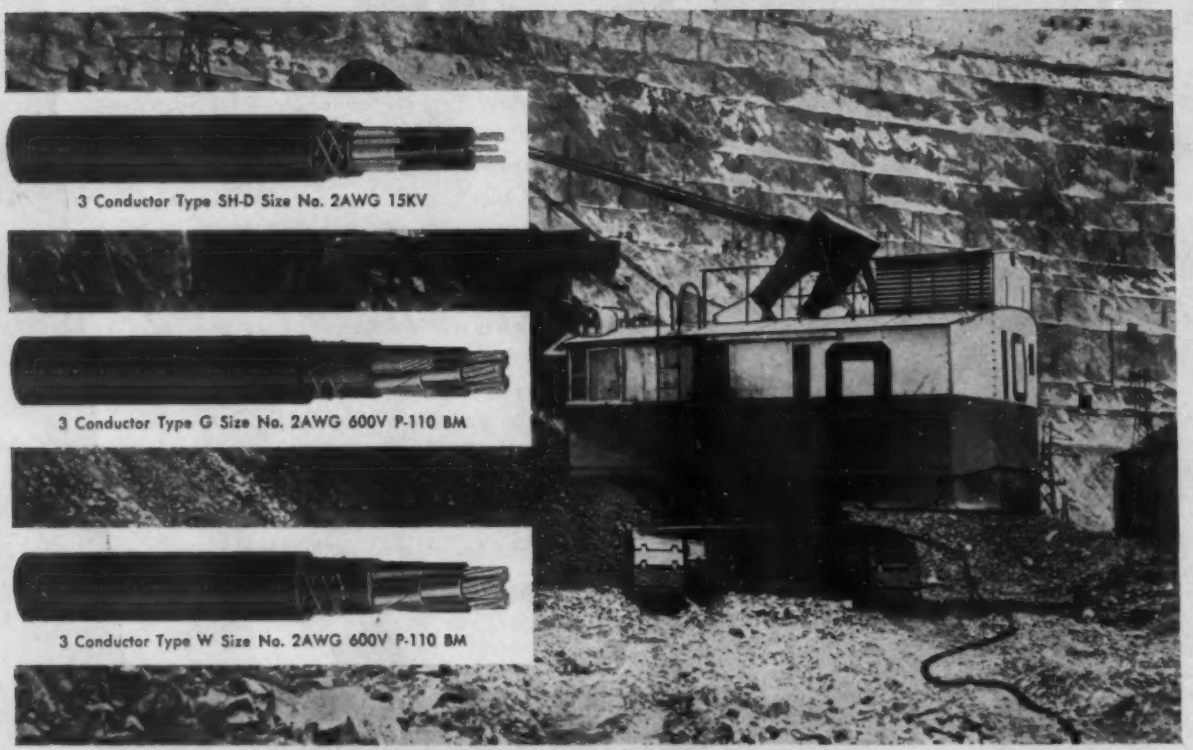
3 Conductor Type SH-D Size No. 2AWG 15KV
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Control of electrode holding and slipping, contact clamping, gas pressure regulation, electrode movement and roof lifting are all greatly simplified . . . these operations are mainly automatic and adaptable for remote control.

Low-level electrode clamps reduce electric losses. Hydraulic compression of contact clamps insures uniform pressure, prevents distortion of electrode jacket. Automatic slipping with furnace in full operation replaces production-slowing methods used in less efficient designs.

Gas-tight passage of movable electrodes through roof forms an effective seal, free from friction. All valuable furnace gas is recovered for reuse. Roof lifting gear allows constant check of interior furnace conditions.

Lectromelt engineers welcome inquiries regarding your furnace requirements. Contact Lectromelt Furnace Division, McGraw-Edison Company, 324 32nd Street, Pittsburgh 30, Pennsylvania.

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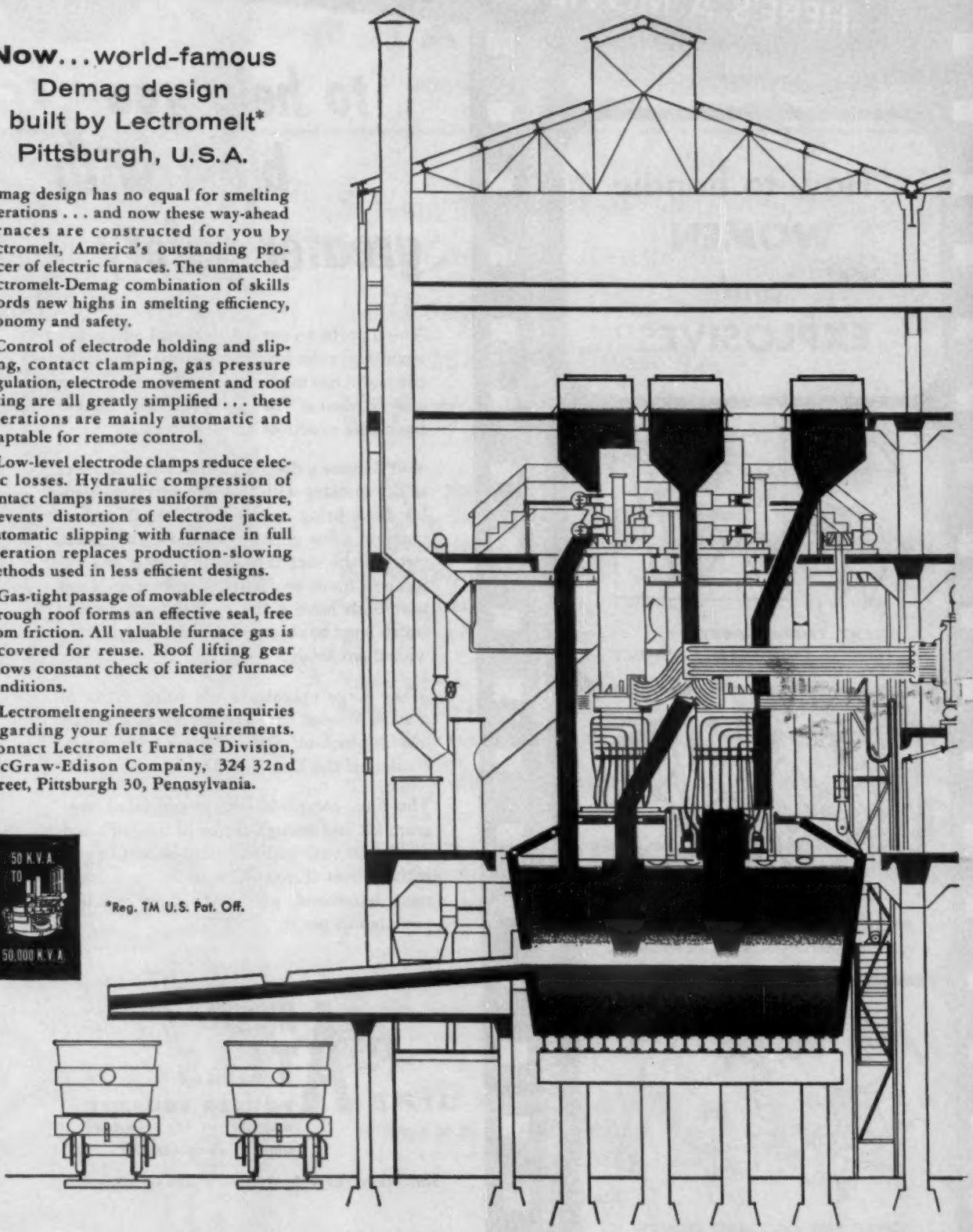

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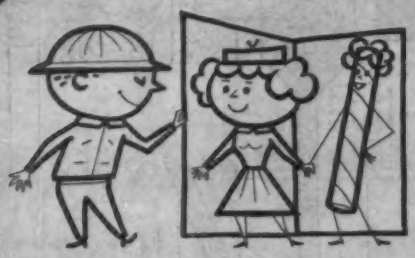
"How to handle WOMEN and EXPLOSIVES"



TREAT THEM GENTLY AND WITH RESPECT

PROTECT THEM FROM UNAUTHORIZED PERSONS

OBEY THE DO'S AND DON'TS

to help you blast with greater safety

You'll protect your safety record and gain a smoother, safer blasting operation if you use the new Atlas movie "*How to Handle Women and Explosives*" to help your men observe basic safe practices in their work.

You'll make a deep impression at your next safety meeting with this film which is calculated to bring out amused chuckles and possibly a few guffaws. At the same time it stresses the fact that both women and explosives must be "handled with care" and that both have a list of Do's and Don'ts which must be observed in order to get along with them safely.

Many large operations are using "*How to Handle Women and Explosives*" as a safety meeting kick-off and following with a discussion of the Do's and Don'ts case insert.

The film, complete with a suggested program kit and enough copies of the Do's and Don'ts for your audience, will be sent to you without cost if you write us on your company letterhead, giving the date or dates you plan to use it.

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Settling Solids with AEROFLOC® Reagent Reduces Downtime and Maintenance Costs in Underground Pumping System

For several years, West Driefontein Gold Mining Company, Ltd. in South Africa has used AEROFLOC 3000 Reagent to flocculate solids in their underground sumps and thus eliminate excessive pump-wear. Only 65-70 pounds of AEROFLOC 3000 Reagent per day are required at this gold-uranium operation to treat approximately 6½ million gallons of water—a concentration just slightly over 1 ppm.

Formerly, treatment with lime caused scale deposits in pumps and pipelines, requiring acid descaling of the pumps every 250 hours. Downtime, labor, supervision and parts replacement were excessive.

Since using AEROFLOC 3000 Reagent, scaling has been eliminated. Pumps are now opened for inspection after 10,000 hours operation. Downtime and labor costs have been cut markedly. In addition, sump overflow is now clear. Additional slime, previously not settled with lime, collects in the sumps, providing a small increase in gold recovery.

If you are interested in testing the AEROFLOC Reagents for settling underground sludge at your operation, we will be pleased to send samples. Write to our nearest office or technical representative.

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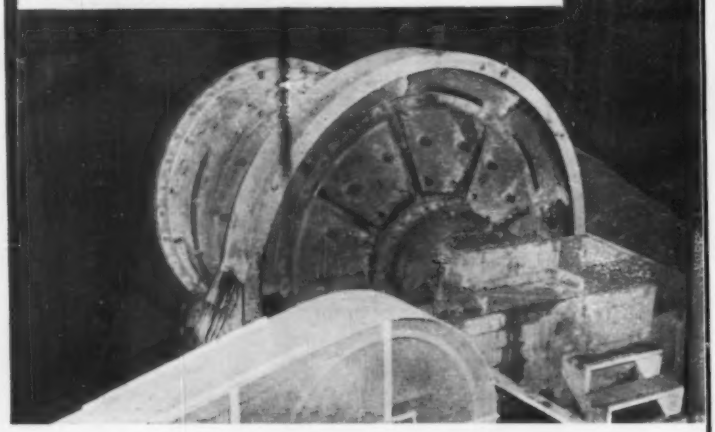

Longer Wearing, Simple Design gives Lower Grinding Cost per Ton

Because of their many superior features, DENVER Steel-Head Mills will solve your most difficult grinding problems—giving you savings in initial cost, in maintenance, in repairs.

Follow the lead of mill operators the world over who have COMPARED and SELECTED DENVER Mills—on the basis of capacity, dependability, performance and price. When you compare, you too will agree that DENVER Mills are your best value.

For assistance with your grinding problems, write today. Bulletin B2-B13 describing DENVER Mills on request.

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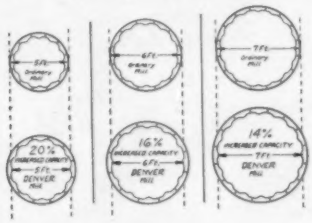
INCREASED CAPACITY— Save on Initial Cost

DENVER Steel-Head MILLS are measured inside liners, have greater capacity than machines measured inside shell. — Up to 28% increased capacity — gives you lower price per ton of capacity.



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Mining World

THE IMPORTANT MINING MAGAZINE EVERYWHERE

October 1957

INTERNATIONAL PANORAMA

GRANTS, NEW MEXICO—Rare Metals Corporation of America has drilled out a large enough uranium ore body in Ambrosia Lake to warrant construction of a mill.

SAN FRANCISCO, CALIFORNIA—The Commodity Credit Corporation bartered $105,800,000 for foreign lead and zinc for the supplemental stockpile in fiscal 1957.

SILVERTON, COLORADO—A new company has been formed to operate the zinc-lead-silver-gold properties of the Shenandoah-Dives Mining Company and the Old Hundred Mining Company. The new company formed by Marcy Exploration and Mining Company is named the Marcy-Shenandoah Corporation. Shenandoah-Dives was a leading metal producer for 25 years before closing in 1953.

ATHENS, GREECE—Mycobar Mining Company has officially opened its new barite mine and crushing plant on the island of Myconos. Barite will be used for oil well drilling mud.

ROUND MOUNTAIN, NEVADA—Round Mountain Gold Dredging Corporation has awarded a 33,155,000-cubic-yard stripping contract to Morrison-Knudsen Company at its gold placer mine here. Following stripping 38,722,000 yards of gravel will be mined and milled.

HAVANA, CUBA—The Cuban American Nickel Company has completed financing for a $100,250,000 nickel-cobalt mine and refineries to produce 50,000,000 annual pounds of nickel and 4,400,000 of cobalt.

VANCOUVER, BRITISH COLUMBIA—Phelps Dodge Corporation has formed a new Canadian subsidiary—Felpscan Mines Ltd.—to lease and option the Colossus Mountain nickel properties of Colossus Nickel Development Ltd.

ROME, ITALY—Drilling south of here, near Pomezia has indicated 10,000,000 tons of sulphur ore in an area two miles long and one-half mile wide.

SAN FRANCISCO, CALIFORNIA—United States production of uranium oxide during first six months of 1957 totalled 8,282,000 pounds of U_3O_8.

SANTIAGO, CHILE—Compania Minero Cerro Negro is developing a promising copper deposit near Cabildo, Aconagua, Province. Several millions of tons of 3.0 percent copper have been developed with an average thickness of 35 feet.

NEW YORK, NEW YORK—Three companies have formed a $55,000,000 integrated firm to product titanium, zirconium, and other light metals. P. R. Mallory & Company, Sharon Steel Corporation, and National Distillers and Chemical Corporation have formed Mallory-Sharon Metals Corporation, with all three participating equally on the board of directors.

JOHANNESBURG, UNION OF SOUTH AFRICA—Uranium oxide production in South Africa for the first six months of 1957 was 5,449,315 pounds from 10,335,444 tons milled. An average of 0.513 pound per ton. Total 1956 output was 8,449,259 pounds.

KIMBERLY, NEVADA—Consolidated Coppermines Corporation is installing an inclined skip hoisting system to hoist ore and waste from its deep Tripp pit.

RISDON, TASMANIA—The Tasmanian Department of Mines will diamond drill large iron ore deposits indicated by airborne magnetometer surveys at Savage River, Rocky River, and Long Plains.

MOAB, UTAH—The Uranium Reduction Company's 1,500-ton-per-day uranium mill here was the world's second largest uranium concentrate producer during first six months of this year. The plant was formally dedicated on September 14.

ANTOFOGASTA, CHILE—Empresa Minera de Mantos Blancos, S. A., will spend $12,800,000 to bring the Mantos Blancos copper ore body into production and build a smelter. The International Finance Corporation, American Overseas Finance Company, and the Mauricio Hochschild interests will finance the operation.

U. S. and South African Uranium Output Revealed

The steady growth of the domestic uranium industry is well outlined in figures just released by the United States Atomic Energy Commission covering the first six months of 1957.

Uranium concentrate production, rate of processing uranium ores, rate of ore production, ore fed to milling plants, ore tonnage in stockpiles, and ore reserves all increased in that peroid over corresponding figures for the last six months of 1956.

Uranium concentrate output totaled 8,282,000 pounds of U_3O_8 with May output reaching a new monthly high of 1,614,000 pounds. Total 1956 output was 12,000,000 pounds. May and June daily tonnage treated at all mills totaled 9,600. Ore production in June was also a record 301,000 tons. In May 297,000 tons of 0.27 percent U_3O_8 ore was milled.

For the six months all ore bought by mills and government purchase depots totaled 1,706,000 dry short tons averaging 0.25 percent U_3O_8 containing about 4,250 tons or uranium oxide, or about 3,825 tons of uranium metal containing about 280 tons of fissionable uranium.

These figures show how much material must be handled to produce the fissionable uranium. However, the true significance of this uranium is only apparent when one remembers that the theoretical energy in the uranium is the same as that in about 560,000,000 tons of coal.

All milling figures are based on 12 operating mills. Since July 1 three additional mills have gone into production and two additional should start before year's end so that the last six months of this year will show greater production figures.

Mills recently starting operations were: Western Nuclear Corporations' mill at Jeffrey City, Wyoming; Dawn Mining Company (Newmont Mining Corporation) at Ford, Washington; and Trace Elements Corporation (Union Carbide Nuclear Company) at Maybell, Colorado. Union Carbide's Nuclear Rifle, Colorado mill and Texas-Zinc Minerals Company (Texas Company and New Jersey Zinc Company) mill at Mexican Hat, Utah will start later this year.

South African uranium production figures for the first six months have also been announced as have those for all of 1956. Figures in brackets are for all of (1956). Tons treated for uranium, 10,335,444 (17,967,237); pounds U_3O_8 recovered, 5,299,347 (8,449,259); pounds uranium recovered per ton treated, 0.513 (0.47); estimated uranium working profit, £15,631,748 (£24,622,054).

Read in November Mining World How Zinc-Lead Is Milled in Greenland

CASTING ZINC on the condenser floor of Imperial Smelting Corporation's Avonmouth, England smelter. Zinc is rated Prime Western grade and averages 98.705 percent zinc, 1.2 lead, 0.024 iron, 0.07 cadmium, and 0.001 arsenic.

New Smelting Technique Uses Blast Furnace To Recover Zinc and Lead

By S. W. K. MORGAN

Zinc metallurgy enters a new era with the successful development of a blast furnace, smelting of zinc bearing charges of various grades and compositions to yield metallic zinc, and lead bullion containing any precious metals in the charge.

This important smelting development has been proven on a large scale at Avonmouth, Bristol, England by the Imperial Smelting Corporation, Ltd. where two furnaces producing 30 and 40 tons of zinc per day and varying amounts of lead have recovered more than 70,000 tons of zinc metal from a wide variety of charges.

Mr. Morgan is research director, Imperial Smelting Corporation, Ltd. This article is based on a paper by Mr. Morgan which will be published by the Institution of Mining and Metallurgy, London, England. Publication of this abstract was made possible by the cooperation of the secretary of the Institution, and Lord Kirkwood, chairman, Imperial Smelting.

How Zinc Is Reduced

The pyrometallurgical problems of zinc smelting are governed by the facts that zinc oxide is reducible with difficulty and zinc metal is volatile. At atmospheric pressure, zinc oxide can be reduced by carbon only above the boiling point of zinc. Most of the world's zinc is produced in either small horizontal or large vertical retorts, in which the essential reaction is: $ZnO + C = Zn\,(gas) + CO$ . . . (1) This reaction between two solids proceeds in two stages:

$$ZnO + CO = Zn\,(gas) + CO_2 \quad . . . (2)$$

and

$$CO_2 + C = 2CO \quad . . . (3)$$

At the temperature (950° C. upwards) at which the gases are generated in the retort, the equilibria in both reactions (2) and (3) are such that the ratio of carbon dioxide to carbon monoxide is small. Therefore, the gas produced contains but little carbon dioxide (less than 1 percent) and since the only oxygen available for combining with carbon is that originally combined as zinc oxide, the gas, as shown by equation (1), consists essentially of equal volumes of zinc vapor and carbon monoxide, from which the zinc is condensed by cooling.

The equilibrium in reaction (2) becomes still more displaced to the left as the temperature is lowered. Consequently, as the gases are cooled for condensation, there is some tendency for even the small amount of carbon dioxide present to oxidize the zinc vapor. The overall reaction (1) is the sum of two strongly endothermic reactions (2) and (3). Therefore, in retort smelting a large amount of heat has to be supplied through the retort walls, and the amount of zinc that can be smelted per unit area of retort wall is limited.

Zinc Reduction Processes

In 1929 the New Jersey Zinc Com-

pany solved a number of problems to develop the first continuous distillation process in large vertical retorts constructed of silicon carbide bricks.

The volatility of zinc precluded its being tapped direct from a furnace, like the other metals. In the types of furnaces used for most metals, the heat required for the reduction reactions is provided by fuel which is burnt in contact with the charge. To produce zinc metal from such furnaces, it would be necessary to condense the zinc from its mixture with a large volume of combustion gases, and this for long constituted an insuperable difficulty. The first successful process for producing a gas of essentially the same composition as from retorts, but in a large furnace, was the electrothermic method, using the electrical resistance of the charge to supply the heat required, developed by the St. Joseph Lead Company in 1931.

The electrolytic process, first successfully operated in 1916 at Anaconda, Montana; Trail, British Columbia; and Risdon, Tasmania, is now widely used, particularly where power is cheap and plentiful. The rate of growth of the process can be gauged from the fact that in 1953 38 percent of the world consumption of primary zinc was produced by the electrolytic process and 62 percent by the retort processes. All retort processes suffer to some extent from the fact that the considerable amount of heat required to carry out the reduction of zinc oxide must be forced through a refractory wall.

Why Blast Furnacing Failed

Although the volatility of zinc introduces complications into its metallurgy as compared with other metals, yet from one point of view it gives zinc an advantage over other metals reduced only with difficulty, such as manganese, by making it possible to effect a clear-cut separation from the more reducible non-volatile metals, particularly iron, with which it is associated in its ores. It would be thermodynamically possible to reduce zinc oxide directly to liquid zinc under pressure, but even if such a process could be operated it would be pointless because all the iron present would be reduced and only a zinc-iron alloy, requiring a redistillation to separate the zinc metal, would be obtained. The efforts made in the past to operate zinc blast furnaces under pressure so as to prevent the zinc being volatilized were all unsuccessful; what does not seem always to have been realized is that their objective was a mistaken one.

Why Zinc Blast Furnacing Is Important

DIRECT SMELTING TO LIQUID ZINC as developed and commercially proven by Imperial Smelting Corporation, Ltd. at Avonmouth, England opens many new approaches for treating of both zinc, and mixed sulphide ores and concentrates to yield metallic zinc. Lead content of charge is simultaneously recovered as lead bullion. Silver, gold, antimony, and small amounts of copper in charge are collected in the bullion. Copper, when present in an appreciable amount, is recovered as a matte whether lead is being tapped or not.

HIGH-IRON FURNACE CHARGES present no problems and this material can be smelted with ease in contrast to the difficulties encountered when treating high-iron material by conventional retorts or electrowinning. In the blast furnace the iron oxide is not reduced and the opportunity of treating a self-fluxing charge is attractive.

MIXED LEAD-ZINC CONCENTRATES can be easily smelted to directly recover both lead and zinc as metals. This is especially important for those ores in which components cannot be completely separated by flotation.

UNIT SIZES ARE LARGE in contrast to retort processes. The large furnace at Avonmouth produces 40 tons of zinc per day. The desirable furnace size is envisaged as burning 90 to 100 tons of carbon per day.

CARBON FUEL TO ZINC VOLATILIZED RATIO for high-grade mixed lead-zinc concentrate is about 104 percent of the weight of zinc. However, coke consumption is less than total coal used for retorting.

CHARGE, free from fines, is essential; sinter has proven satisfactory.

ZINC RECOVERY, as metal, is 89 per cent of the zinc volatilized. Remaining zinc is periodically recovered in dross and blue powder.

New Studies Made

A study showed that the zinc blast furnace could be thermally efficient in its own right only if the gas generated contained a considerable amount of carbon dioxide. The primary problem to be solved was recognized to be that of condensing zinc from a gas containing a relatively low concentration of zinc vapor and a considerable amount of carbon dioxide.

The guiding considerations in the first experiments at Avonmouth were that a ferruginous slag was to be run off from the furnace, and that, therefore, the gas initially generated there would contain some carbon dioxide; the zinc oxide would be reduced by the reaction:

$$ZnO + CO = Zn(gas) + CO_2 \quad \ldots (2)$$

and therefore the final gas produced would contain more carbon dioxide than zinc vapor. Reaction (2) is reversible, and fall of temperature moves the equilibrium towards the left-hand side of the equation. Consequently, it was realized that special precautions would have to be taken to avoid oxidation of zinc vapor by carbon dioxide at all stages from its generation in the furnace to its condensation: (1) To avoid re-oxidation of zinc within the furnace, the whole furnace charge must be maintained above the zinc re-oxidation temperature; (2) To avoid re-oxidation during the passage from furnace to condenser, the gases must not fall below their re-oxidation temperature; and (3) To avoid re-oxida-

tion in the condenser, the gases must be rapidly cooled.

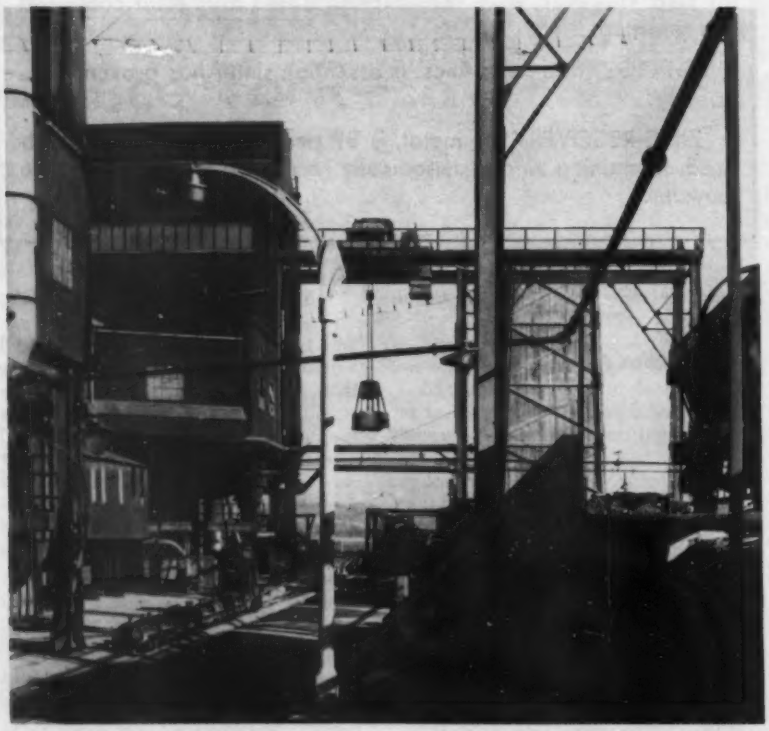
Experimental Furnace Designed

The first point was met by a design in which a shaft was fed with a mixture of preheated coke and sintered zinc concentrates with air blast introduced both at top and bottom, and the gases withdrawn at a middle level. To meet the second requirement, the gases passed from the furnace through a column of coke heated electrically.

The test unit yielded a gas containing 2 to 3 percent zinc vapor and 6 to 8 percent carbon dioxide. In the first tests the gases were shock chilled to produce zinc dust. The fact that this zinc dust contained 98 percent metallic zinc proved that the means adopted had been adequate to prevent oxidation of zinc vapor. The key to the development of a successful condenser was the discovery that the use of liquid lead as a circulating medium for heat transfer and collection of zinc enabled oxidation of zinc vapor to be minimized. Liquid lead, even when containing 2 to 3 percent zinc, could be pumped and handled with ease, so that the way was opened to the use of a number of devices such as are familiar in the scrubbing of gases by liquids. Particularly promising results were obtained by passing the furnace gas into a chamber containing a pool of liquid lead which was showered into the gas by the action of a rotating fluted roller. Cooling the lead leaving the condenser caused separation of liquid zinc; pumping the lead in a circuit, made up of the condenser chamber, an external cooler, and a zinc separation bath, provided a method of continuous removal of both heat and zinc from the furnace gases and continuous separation of the zinc as a liquid layer above a liquid lead bath.

Lead Can Be Recovered

In the experimental plant the treatment of roasted zinc concentrates was studied in detail. Following this work the extension of the process to other types of charge was explored. The smelting of charges containing both zinc and lead values was a problem which had already arisen in connection with the treatment of zinc concentrates, since the dross and blue powder produced in the condenser, using liquid lead as a scrubbing medium, was a mixed zinc-lead material, and its return to the smelting charge resulted in an appreciable lead feed to the furnace. Increasing the lead content of the charge by treatment of lead-zinc ores or of mixtures of lead and zinc concentrates involved new problems in condensation and in the handling of the products, now including bullion and matte as well as slag, from the furnace bottom. These problems were solved and a situation reached in which the simultaneous smelting of lead imposed no additional burden on the zinc smelting operation. It was found, for instance, that allocation of coke for smelting the charge could be estimated from the requirements of zinc elimination and slag melting; no extra coke was required for the lead to be treated. The elimination of zinc and the efficiency of condensation was as high as in the treatment of roasted zinc concentrates, the explanation being that with lead oxide present in the charge a still higher carbon dioxide content in the gas could be achieved without increasing the zinc content of the slag. The bullion produced collected the silver content of the charge and a substantial portion of the antimony. The treatment of low-grade charges was also studied, particularly zinciferous lead blast furnace slags and types of low-grade zinc or mixed lead-zinc ores. These types of material were successfully smelted to yield metallic zinc.



TWO FURNACES having capacities of 30 and 40 tons of metallic zinc per day have now produced more than 70,000 tons of zinc. The furnaces have a water-jacketed bottom with water-cooled tuyères and a brick-lined top shaft.

Avonmouth Furnaces

Two pilot production furnaces were built at Avonmouth, one with a nominal capacity of 20 tons of zinc output per day, the other of 25 tons per day. Between them these furnaces have produced more than 70,000 tons of zinc. The furnaces have a water-jacketed bottom section, with water-cooled tuyères, and a brick-lined top shaft. The smaller furnace has 16 tuyères, and a hearth area of 55 square feet; the larger, 20 tuyères and an area of 69 square feet. The tapped slag is granulated; with the development of zinc-lead smelting, arrangements for collection of matte and bullion in an external settler have been added. The hot zinc-containing gases are withdrawn above the furnace charge; the furnace top is totally enclosed, batch charges being introduced via a double bell system. The gas from each furnace passes to two condensers, one on each side of the furnace. In each condenser there are three vertical shaft rotors in series, dipping in successive stages into the lead pool in the bottom of the condenser. The rotor creates an intense shower of lead droplets, which cools the gas to a temperature near that of the lead. By placing the rotors in successize stages, with an appropriate lead flow countercurrent to the gas stream, the gases leaving the furnace are rapidly chilled below 600° C. and further cooled to about 450° C. before they leave the condenser. The uncondensed zinc leaving the condenser in the gas is thereby reduced to below

5 percent of the total entering the condenser. The gas is further scrubbed, first in a spray tower, then in Theissen-type disintegrators; the scrubbed gas (calorific value 70 to 80 BTU's per cubic foot) is used in the plant to preheat air and charge, and the surplus burned in boilers. The water from spray towers and disintegrators passes to a Dorr thickener to recover the blue powder, which is filtered before return to the sinter machine charge. On each condenser lead is pumped at a rate of 300 to 400 tons per hour through a circuit comprising the condenser, a pump chamber, a long water-cooled launder, and a separation bath. Control of heat removal is effected by varying the area of water-cooled surface immersed in lead, and adjustment of temperature differential between the hot and cold ends of the condenser by alteration of lead pumping rate. The launders cool the lead stream to about 450° C.; cooling is completed in the separation bath in which the liquid zinc separates as a top liquid layer. By suitable disposition of overflow levels for zinc and lead, a zinc layer approximately 15 inches deep is maintained on the bath, and this zinc overflows continuously into a bath for reheating and for treatment with sodium to remove arsenic. The cold lead returns continuously to the condenser.

The zinc produced is Prime Western Grade and assays as follows: Zn, 98.705; Pb, 1.2 percent; Fe 0.024 percent; Cd, 0.07 percent; and As, 0.001 percent.

Slag, matte, and bullion are periodically tapped from the furnace, the matte and bullion being retained in an external settler, the slag passing on to a granulating system. The slag composition varies somewhat with the type of gangue in the concentrates treated. Its zinc content may range between 1 and 5 percent, but with close control of charge composition and proportioning, steady running with a zinc content of 2 to 3 percent can be consistently maintained. The lead content of the slag is about 0.5 percent, depending mainly on the efficiency of separation in the forehearth. The air blast is heated in alloy tube recuperators fired with scrubbed furnace gas, the heaters installed at present allowing a maximum preheat of 550° C. The charge is heated in a vertical shaft with a countercurrent stream of burned furnace gas. Automatic control arrangements ensure provision of a neutral mixture of gas and air, with sufficient recycle of the gas leaving the charge preheater to prevent overheating and slagging at the base. The process lends itself to instrumental and automatic control, and this aspect has been exploited. The furnace is operated at constant controlled blowing rate, and the gas leaving the furnace is split between the two condensers by automatic damper control. The firing of air heaters is automatically controlled to fixed air temperature and of charge heaters to provide neutral gas at a fixed inlet temperature.

The Heat Balance

Considering first the elimination of zinc from the furnace charge, the amount of zinc produced per unit of carbon burned is governed by the heat balance. The input of heat is the sum of:

(1) The heat of combustion of carbon partly to CO, partly to CO_2; and (2) The sensible heat of preheated air and preheated charge. The heat is consumed in:

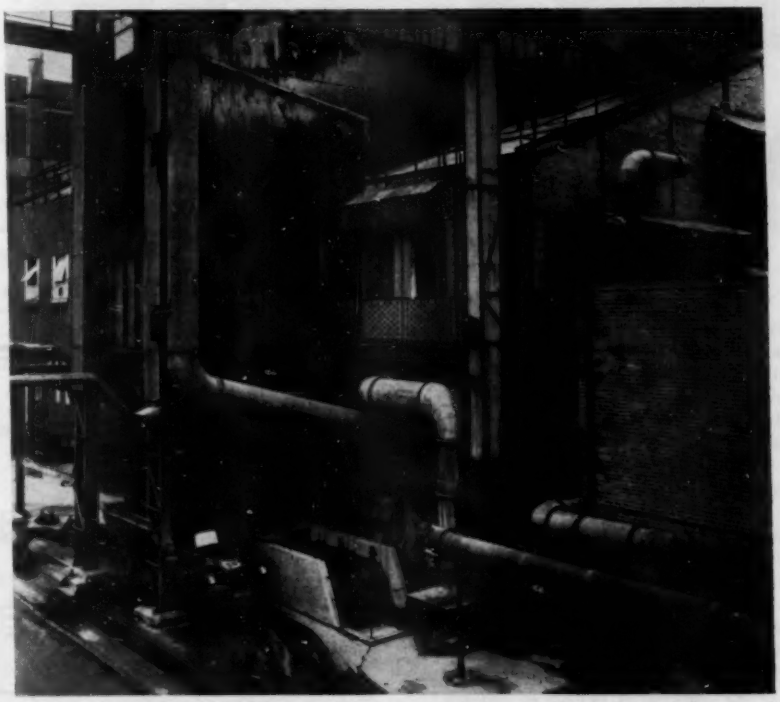
(a) Slag melting; (b) Heat losses; (c) Sensible heat of gases leaving the furnace (at a temperature not greatly removed from the equilibrium condition for the reaction $CO + ZnO = CO_2 + Zn$); (d) Endothermic reduction of zinc oxide by carbon monoxide; and (e) Reduction of carbon dioxide $CO_2 + C = 2CO$. A heat balance drawn up in this way clearly depends markedly upon the actual level of CO_2 in furnace gas achieved in the operation; the higher the percentage CO_2, the more zinc oxide can be reduced per unit of carbon. The level of CO_2 is dependent upon a complexity of conditions, including the temperature of the charge column, the reactivity of coke (in reducing carbon dioxide) and of the zinciferous charge (producing carbon dioxide). A typical operation yields gas leaving the charge containing 5 to 6 percent zinc vapor, and 8 to 10 percent CO_2. Such gas has an equilibrium re-oxidation temperature of 960 to 1,000° C.

Decreasing the amount of zinc left in the slag by increasing the coke-zinc ratio (and thereby increasing the ratio of carbon monoxide to carbon dioxide) is undesirable, not only because it reduces the zinc throughput, but also because the furnace gases must not be made so reducing that high-melting metallic iron is formed at the bottom of the furnace.

Slag Calculations

Since the thermal economy of the furnace is improved by decreasing the CO to CO_2 ratio, requirements are best met if the slag composition is such that its iron oxide activity is high and the activity coefficient of zinc oxide is high.

Rather poor zinc elimination is obtained with the type of slags generally used in lead smelting, but a low zinc content of slag is obtained by increasing the lime content; the lime can be added either at the furnace or in the charge to the sinter machine. Good



SLAG GRANULATION at No. 2 blast furnace. Slag composition varies with type of gangue in concentrates smelted. Zinc content may vary from 1.0 to 5.0 percent, but with close control of charge it is 2.0 to 3.0. Lead in slag averages 0.5 percent.

zinc elimination is further favored by the use of a reactive and porous sinter, and by ensuring an even charge distribution in the furnace.

The ratio of fuel burnt to zinc volatilized depends on a number of factors such as the temperatures to which the air blast and the charge are preheated, the heat loss from the furnace, and the amount of slag-forming materials present. On a typical furnace, with charge preheated to 800° C., and air blast to 600° C., the carbon consumption may be calculated as the sum of 90 percent of the weight of zinc to be volatilized, and 20 percent of the weight of slag to be formed. With a high-grade mixed zinc-lead concentrate in which the weight of slag formed may be 70 percent of the weight of zinc present, this means that the carbon consumed might be about 104 percent of the weight of zinc reduced and volatilized.

In condensing the zinc content of the furnace gas the primary object is to prevent the re-oxidation reaction, $CO_2 + Zn = CO + ZnO$ by shock chilling. Rapid cooling tends to promote fog formation but the seriousness of this aspect is lessened by (a) the high superheat of the gases, which have a dew point of about 650° C. and leave the furnace at 900° to 1,000° C., and (b) the presence of a rain of unsaturated lead in which droplets of zinc are formed, but are themselves scrubbed by the intense rain of lead.

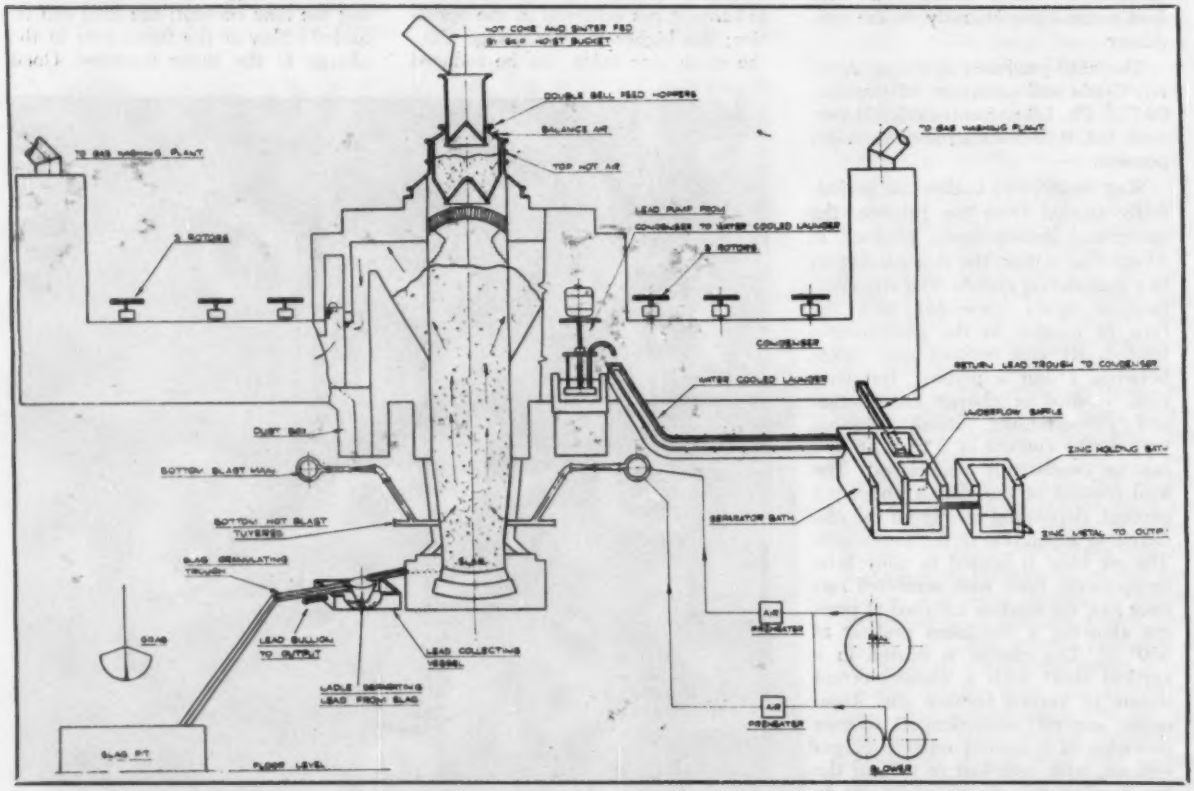
In condensing a gas containing 5 percent Zn, by countercurrent scrubbing with cool liquid lead saturated with zinc, the quantities of heat and zinc are such that the lead becomes unsaturated as it becomes hotter. A typical situation would be: Cool lead, 440° C., 2.02 percent Zinc (saturated); Hot gas, 5 percent Zinc, 1,000° C. to be cooled to 450° C.; and Hot lead, 570° C.

The quantity of lead required by the heat balance is such that it rises only 0.24 percent in zinc content and leaves, therefore, containing 2.26 percent Zn, compared with a saturation value of 4.9 percent Zn. Lead has to be circulated at a very high rate $\frac{100}{0.24} = 420$ times the rate of zinc production, in order to maintain this situation.

Under favorable conditions about 89 percent of the zinc vapor entering the condenser is condensed and recovered as molten metal. The remaining 11 percent of the zinc vapor is recovered in the dross periodically removed from the condenser and in the blue powder washed out of the condenser exhaust gases. Both the dross and blue powder contain lead. Typically, the blue powder contains 32 percent zinc and 45 percent lead, and the dross 43 percent zinc and 36 percent lead.

Lead Gets Free Ride

The reduction of lead oxide by carbon monoxide is slightly exothermic and, since this is in fact the reaction by which lead oxide is reduced in the furnace, the lead content of the furnace charge makes no demand upon the carbon, which is calculated in terms of the zinc to be eliminated and the slag to be melted. This feature of the process whereby lead is a passenger has been confirmed in the smelting of many zinc-lead charges. This effect is gained at the expense of a higher carbon dioxide content of the gas, but satisfactory condensation can still be attained. The condenser gas with high lead charges may contain 11 to 12 percent CO_2, with 17 to 19 percent CO, its calorific value being thus only about 60 BTU's per cubic foot. It is still more than sufficient for preheating the charge and air blast; about half the total gas produced is available for other uses.



ZINC BLAST FURNACE and auxiliary equipment. Charge is fed through double-bell system. Lead and slag are tapped at furnace bottom. Furnace gases, 5.0 to 6.0 percent zinc, are brought into contact with shower of molten lead in condensers whereby 89 percent of zinc is condensed and recovered as metal which separates as top liquid layer in separating bath.

Most of the arsenic present in the charge can be tapped as a speiss from the furnace, but some of it is volatilized and collected with the zinc metal, from which it can be removed by treatment with sodium. When lead is being tapped from the furnace, it collects nearly all the antimony; any volatilized antimony collected with the zinc metal is removed by the sodium treatment. When sufficient sulphur is present, a matte is tapped from the furnace hearth.

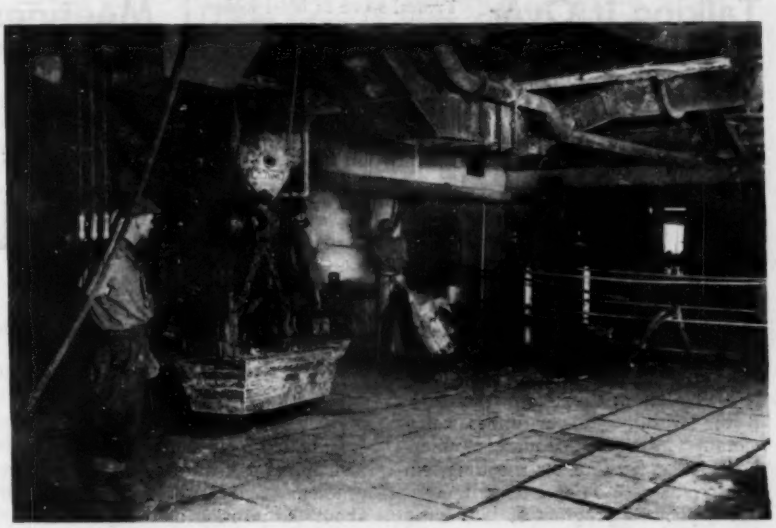
Many Types Of Charges

The process provides a method for treating a variety of zinc-bearing materials to yield metallic zinc. As a blast furnace process it is not subject to the limitations on unit size of the retort processes; the larger unit at Avonmouth producing 40 tons of zinc per day is judged to be decidedly smaller than the optimum. The desirable size of furnace is envisaged at the present stage of the development as burning 90 to 100 tons of carbon per day. The associated air heaters, charge heaters, condensers, and gas scrubbing system are all on a scale such as to yield decided economies in the capital cost per unit of smelting capacity.

The requirements of the process as regards raw materials are similar to those of other blast-furnace operations. The fuel used is coke, typically of 3-inch lump size. The zinciferous materials are desirably also fed in lumpy form free from fines, and this has been achieved, in the cases examined so far, by sintering. From the nature of the process, with a hot furnace top and with gases then passing through a condenser, it is clear that good quality charge, free from fines and hard enough to prevent excessive breakdown in the furnace, is called for. Fluxing materials can be incorporated in the sinter (silica in the sinter can perform the dual function of strengthening the sinter and providing the necessary fluxing in the furnace) or added separately. The dross and blue powder are also incorporated with the sinter.

The process can be applied to high-grade zinc concentrates but is not restricted to this type of material. The impurities brought in with the raw materials are rejected as a slag composed mainly of iron oxide, lime, silica, and alumina, and there is some flexibility in the choice of a target composition appropriate to any given ore. A lower grade of ore thus normally involved merely the melting of an additional load of slag, of acceptable composition, with a moderate effect on the coke requirement per unit of zinc.

AIR PREHEATERS are shown at the north end of the plant. Degree of air heating and charge heating has important bearing on carbon consumption in the furnace. Normally air is preheated to 600° C. and the charge to 800° C.



LEAD IS TAPPED into one-ton ingots from the external settler outside the furnace proper which is behind the workmen. Picture shows the slagging floor at the bottom of the furnace. Slag granulation trough extends to right.

While retort processes of electrolytic extraction experience such difficulties with materials very high in iron content as to prohibit their use, in the blast furnace process such materials can be smelted with ease.

The process is particularly useful for smelting mixed lead-zinc concentrates, and has thus opened up the possibility of recovering directly both zinc and lead as metals from those lead-zinc ores in which the components cannot be completely separated by froth flotation. Even if the concentrates contain, besides galena and sphalerite, a considerable amount of pyrite, the sinter-roasted material can be treated in the blast furnace without an unduly high fuel consumption.

The lead content of the raw material is obtained as lead bullion; this position contrasts with that of the zinc processes where at best a lead-rich material for separate treatment is produced, and normally the lead enters a residue.

As in the conventional lead blast furnace, any silver present is collected almost completely in the lead metal, together with other metals such as antimony. Copper present in small amounts can conveniently be collected with the lead. When any considerable amount of copper is present, the copper is tapped as a matte; this applies whether lead is being tapped or not.

THE END

Talking It Over: Typical scene in hotel lobby shows delegates taking a breather and passing time of day.

Meetings: Protection should be provided for our domestic metals and minerals industry says Utah's Senator Watkins.

Import and Tariff Talks Featured At AMC Meeting in Salt Lake City

Foreign mining should share in the re-adjustment of supply and demand in metals and minerals ..... Paradoxically we (the United States citizens) live in the greatest market area in the world, yet our mines can't operate ..... Congress pulled the rug out from under the tungsten industry ..... Mining must undertake a planned program of salesmanship and public relations to correct public indifference to its problems and to educate Congress ..... The very existence of a live long-range minerals program represents a clear cut and precedent shattering victory for mining with the general recognition, by the administration, of the excise tax principle ..... These were comments that filled the air at the 1957 meeting of the American Mining Congress in Salt Lake City, Utah, September 9, 10 and 11.

Broad recommendations for curing the ills besetting the industry were tossed into the hopper by United States legislators and industry leaders. Oddly enough these various proposals coming from a great many sources showed a remarkable similarity in tone. They could be summed up in blunt-speaking Senator Bible's (Nevada) address when he pleaded for (1) a planned program of salesmanship and public relations to educate Congress; and (2) for industry-wide co-operation, on a united front, in formulating policies and programs that will benefit mining. In the past, said Senator Bible speaking of the mining field, "I have found an industry divided against itself." The tungsten miner is aware of only his own problems and doesn't give a hoot about the position of the gold miner. These statements were almost an echo of the substance of Senator Watkins' address at the opening session of the Congress. He too emphasized the strong need on the part of the industry for an education program and pointed to the fine work accomplished along this line in the past by a few pioneers, notably Otto Herres.

On the State of Mining

Copper: "If proper measures can be taken to stabilize the present and near term situation so as to prevent damage to a large segment of the copper industry then the long term outlook is fairly bright," said J. B. Pullen, assistant general manager of Phelps Dodge Corporation. He also said that in the last 20 years the cost of some Arizona copper operations have increased 500 percent and American producers are mining the lowest grade ore and paying the highest wages in the world. Mr. Pullen also advocated adequate import protection. He stated that the peril point on copper should be raised from 24 cents to 32 cents per pound, and that the present 2 cents per pound tax be increased to not less than 4 cents per pound.

Iron Ore: "We may be approaching a new era in the economics and technology of iron ore supply, with tremendous implications for everyone in the business," according to Russell Fish, vice president of operations, M. A. Hanna Company. Large scale taconite production has become a reality .... two methods of direct reduction of iron ore appear to be approaching commercial feasibility ..... and emphasis is still on the improvement of iron ore quality in terms of structure, size and chemical content according to Mr. Fish.

Lead-Zinc: Charles E. Schwab, chairman Emergency Lead-Zinc Committee said that the industry would file its petition for escape clause relief with the Tariff Commission as soon as possible; which if granted would be 2.5 cents per pound for lead and 2.1 cents for slab zinc. He complimented and thanked the industry for its united effort and said that a real educational job had been done in Washington.

Fun: Miner's Jamboree, held at Saltair amusement park on Great Salt Lake, featured a barbecue, floor show and dancing. Event was a big success.

Trips: At U. S. and Lark mine of United States Smelting Refining & Mining Company, delegates had a chance to observe the timber framing shop.

Underground Mining

Development of one of the largest single opening mines in North America was described by G. B. Hamilton, Hogarth mine engineer, Steep Rock Iron Mines Ltd., Ontario, Canada. The mine is being developed for block caving with all production coming from a single level. Plant is geared for a production of 2,500,000 tons of iron ore per year and 30-tons-per-man-shift during the shipping season. Ore from scram drifts will be belt conveyed to underground crushing installation.

In a case for plastics, J. J. Daly, engineer, Minerva Oil Company, told of the use of plastic mine vent tubing made from polyethylene film, wooden hoops and taped seams at an underground fluorspar mine. The tubes are capable of delivering 12,000 cubic-feet of air per minute, are 54 inches in diameter and up to 800 feet long. Mr. Daly reported that the tubing costs approximately $1.34 per foot including installation. Discussing underground loaders, C. O. Dale, assistant general manager, mining and smelting division, Eagle Picher Co., said that a rubber-tire, end loader (used underground) showed these results after 10 months of service: machine hours 3,010; average tons loaded per shift 450; and best tons per shift 850. Total direct cost was $0.152 per-ton-loaded including operator labor, fuel, lubrication, greasing, tires, repair, and supervision.

Milling & Metallurgy

D. S. Sanders, concentrator superintendent, Chile Exploration Company, reported test results with cyclones and possible circuit changes in the mill at Chuquicamata. Cyclones will be used to replace classifiers in the concentrate regrind circuit because testing indicated better metallurgy. Installations are also planned for the primary grinding circuit. The Dorr-Oliver DSM screen offers high capacity separations in the 8 to 100-mesh sizes according to Paul Stavenger and Victor Reynolds of Dorr-Oliver Inc. The screen consists of a stationary housing which holds the concave wedge bar surface and a feed distribution box with a spout to direct feed across the screen in a tangential manner. Wedge bars are oriented perpendicular to direction of feed flow. The screen has been particularly useful in heavy media circuits for draining product. Primary limitation of the screen is that it is not possible to obtain a dry undersize product.

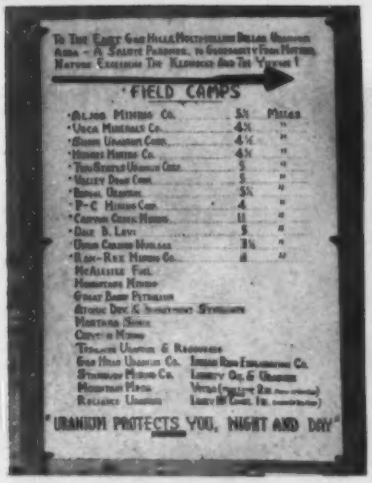
Solvent extraction or more properly liquid-liquid extraction was the subject of several papers. E. H. Crabtree and C. J. Lewis, Colorado School of Mines Research Foundation, presented data which suggested that the exchange of ions between the organic and aqueous phases follows the laws of chemical equivalency. They noted that neutralizing the acidity of the aqueous phase causes metal ion to move into the organic whereas increasing the quantity of aqueous phase hydrogen ion relative to the organic will strip the organic of the metal it has loaded.

Open Pit Mining

Conveyors occupied a good share of the time devoted to open pit mining. E. H. Mulligan, assistant chief engineer, Steep Rock Iron Mines, reported that a fairly extensive system of pit conveyors gave these results: transported 1,000 gross tons per hour; moved about 10,000,000 tons of iron ore through very rugged terrain at a cost of $0.04 per gross ton.

Advances in off-highway truck design were discussed by Gordon N. Carlson, district mechanical engineer, Pickands Mather & Company. The single-axle 20 to 25-ton capacity truck has long been recognized as the base haul unit most applicable for those operations with short hauls, confined working areas and adverse grades. Tandem-axle 30 to 40-ton capacity trucks were developed to fill the need for larger loads and to reduce costs on long hauls and for "flotation." Newer models introduced are stressing 30 to 35-ton capacities in the single-axle style according to Mr. Carlson.

Of course the convention was not without its lighter side. A huge barbecue was held at the Saltair amusement park for the annual miner's jamboree. This event was a smashing success and the steaks were delicious. On Tuesday evening Kennecott Copper Corporation was host to convention delegates at a party held at the 6100 level of the Bingham Canyon open pit mine. Salt Lake City went all out for the miners and provided a good press. See you next year at San Francisco. **The End**



EAST GAS HILLS has been the scene of great activity recently. This sign near Lucky Mc gives names of important companies.

WESTERN NUCLEAR CORPORATION's new uranium mill at Jeffrey City is Wyoming's first. Milling started in July and within 30 days more than 500 tons of ore was being tested daily. Both company mined ore and custom ore mined by Crooks Gap and Gas Hills producers is milled.

Let's Take A Trip to Wyoming and See Why It's Fastest Growing Uranium Area

Wyoming uranium developments are both fast and permanent. Ore reserves—5,300,000 tons—are the third largest of any state, and are rapidly overtaking second place Utah. Reserves have increased 143.47 percent in the last year largely due to deeper drilling in the Gas Hills.

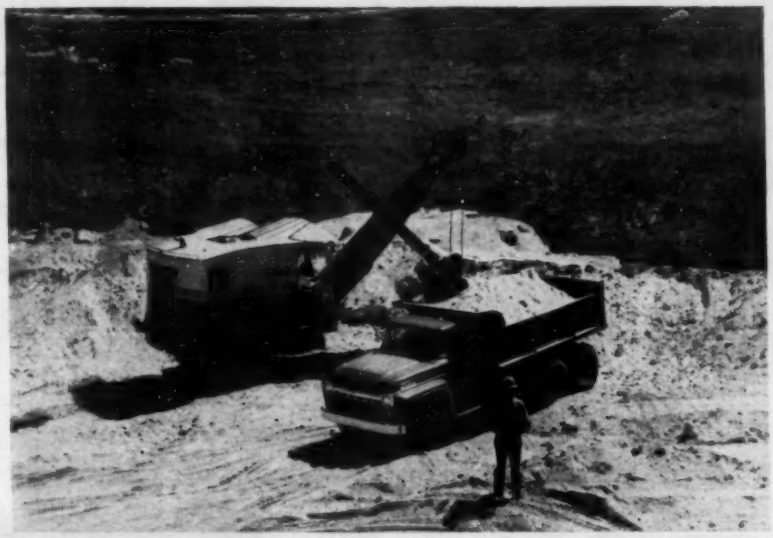
Western Nuclear Corporation's mill at Jeffrey City is operating at greater than rated capacity while Lucky Mc Uranium Corporation rushes construction of its Gas Hills mill. Both companies want to increase capacity. Two other companies want to build new mills.

Large scale stripping operations are in full swing as a prelude to open pit mining. Exploration continues at a fast rate with thousands of acres of favorable formation showing only a few scattered holes.

Here are the highlights of Wyoming uranium pictured on a recent MINING WORLD tour.

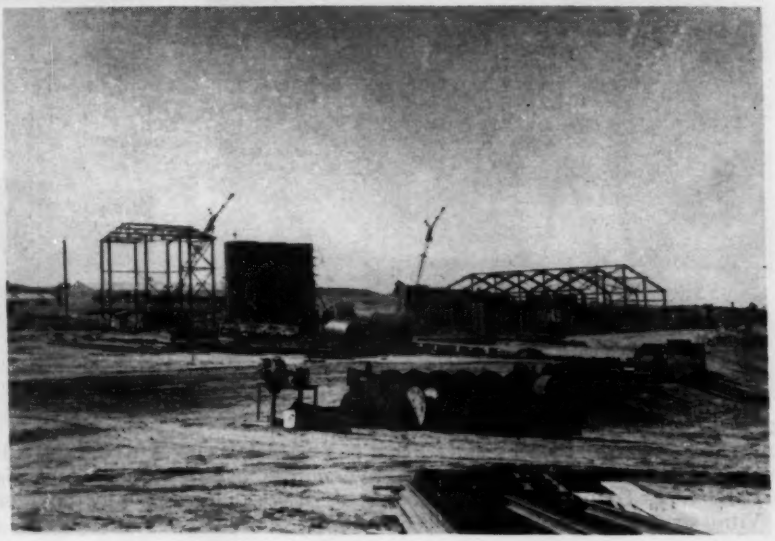
CONTINENTAL URANIUM Company of Wyoming is the largest current producer in the Crooks Gap district. Ore is mined from Siesmic pit and will soon be mined from underground mine where shaft is now being sunk. Rare Metals Corporation of America is drilling at top right.

WESTERN NUCLEAR prospects the Jeep claims near the southwest limit of the Gas Hills. Two drills are busy in this picture.



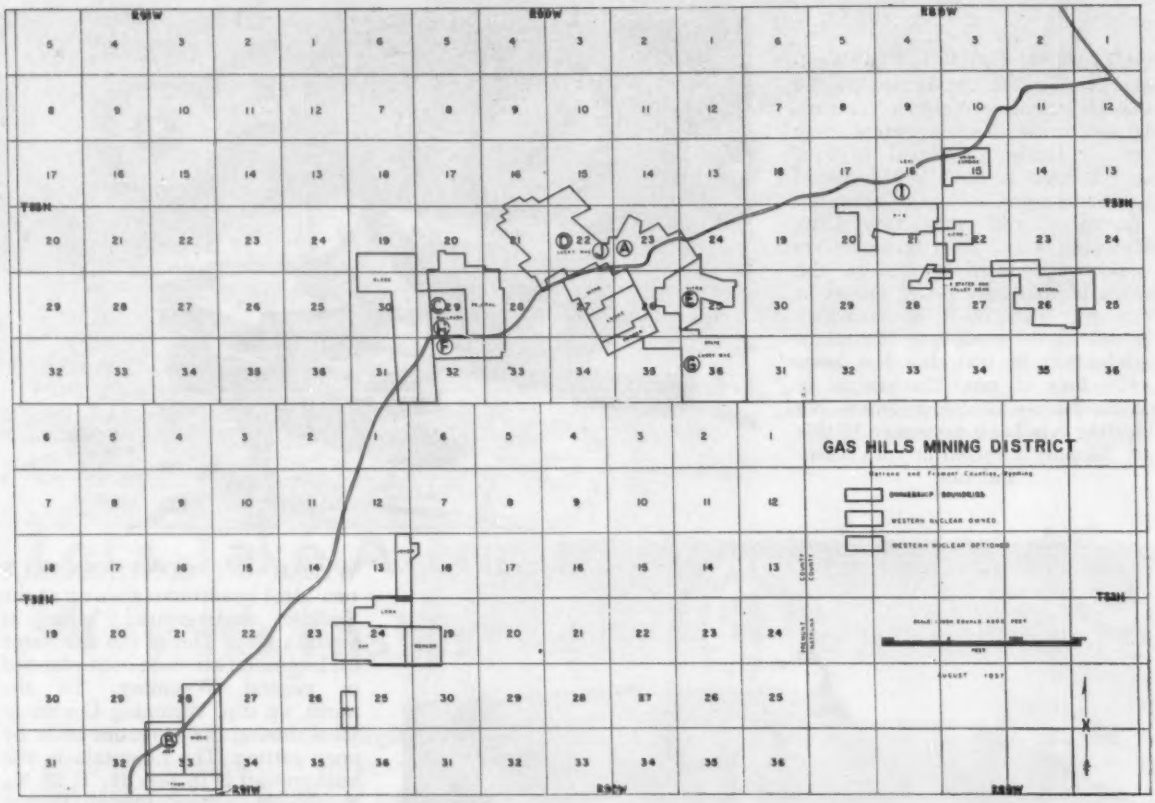
BULLRUSH OPEN PIT of Western Nuclear in the center of the Gas Hills. This is Western Nuclear's largest mine at the present time and is being developed in four stages. Ore is now being mined from stage one and trucked to the company's mill at Jeffrey City. Stripping is underway on stage two which will uncover ore to the south of that now being mined in this pit. This 30-B Bucyrus-Erie Diesel shovel loads ore. Maximum production in one day has been 1,600 tons of ore. The ore is in course friable sandstone lenses. No blasting has been necessary in this pit. Rippers are used in both waste and ore.

WYOMING CONTINENTAL'S new steel headframe goes up at the Siesmic underground mine at Crook's Gap. This is the first large underground uranium mine planned in central Wyoming. To the north, up dip, Wyoming Continental is mining the same ore body by open pitting. The mountain in the background is in Sec. 16, T. 28 N., R. 92 W. where Phelps Dodge Corporation has exercised its option on Wyoming Uranium Corporation's property. The long white scars on mountain slopes are drill roads and drill sites used by PD for exploration drilling. Wyoming Uranium reports 1,670,000 tons of 0.30 percent uranium indicated in this area in nine separate but closely spaced ore bodies.



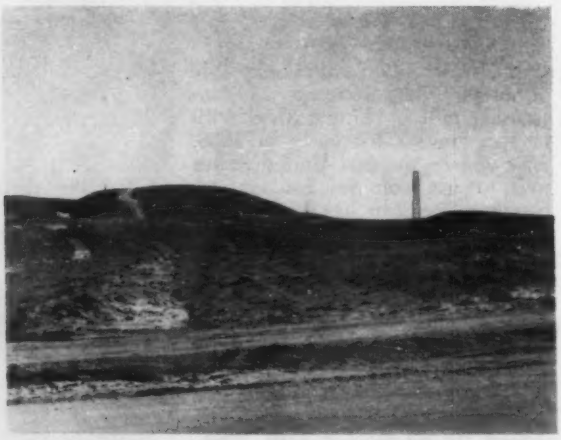
CONSTRUCTION of Lucky Mc Uranium Corporation's 750-ton-per-day mill is being rushed with completion set for early in 1958. This will be the first United States mill to use columns for ion exchange. The firm has already applied to the Atomic Energy Commission to expand capacity by 1,000 tons per day. Phelps Dodge Corporation has joined Lucky Mc in applying for expansion. If granted, Phelps Dodge would be allocated 400 tons per day of capacity to mill ore from its property in Crooks Gap which was purchased by agreement with Wyoming Uranium Corporation, the original claim owners.

Wyoming Uranium Booms



GAS HILLS MINING DISTRICT MAP showing the approximate boundaries of the largest claim groups with ownership designation within the claim boundaries. A series of circled letters from "A" to "J" indicate the locations of the pictures presented on pages 66 through 69. Letter (A) shows the location of EAST GAS HILLS sign directory. (B) WESTERN NUCLEAR prospect drilling on Jeep claims. (C) BULLRUSH OPEN PIT of Western Nuclear is company's largest mine. (D) CONSTRUCTION of Lucky Mc Uranium mill is underway at this point. (E) LARGEST GAS HILLS PRODUCER of uranium to date has been Vitro Minerals Corporation. (F) RADOROCK RESOURCES uses diamond drills on the Sagebrush claims. (G) UTAH DEVELOPMENT COMPANY strips one of two Lucky MC ore bodies. (H) STRIPPING Bullrush ore body for Western Nuclear. (I) DALE B. LEVI COMPANY'S small pit in East Gas Hills. (J) WATER well for Lucky Mc uranium mill.

LARGEST GAS HILLS PRODUCER is Vitro Minerals Corporation which ships to its own mill at Salt Lake City, Utah and Western Nuclear's new mill. Vitro strips with draglines. This is 7¼-yard Marion.

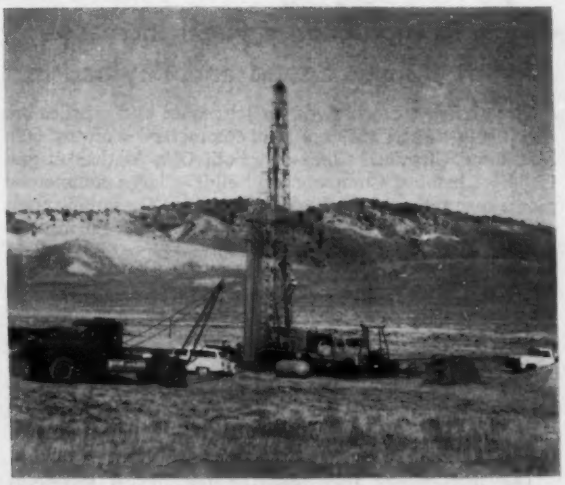


RADOROCK RESOURCES, INC. is drilling on close centers the Sagebrush claims immediately to the south of Western Nuclear's Bullrush mine. Three drills are at work in picture.

UTAH DEVELOPMENT COMPANY is stripping overburden for Lucky Mc Uranium Corporation in the center of the Gas Hills. This will be Lucky Mc's southeastern pit. Stripping is underway two shifts per day so that all stripping can be completed by October 1. The top of the ore is about 10 feet under the pit floor shown in this picture and will be uncovered by the next cut. The coarse grained sandstone has been perfect for scraper loading. Two push tractors are used to fill the 41-cubic-yard heaped capacity Woolridge scrapers to overflowing. M-R-S Special tractors pull the scrapers.

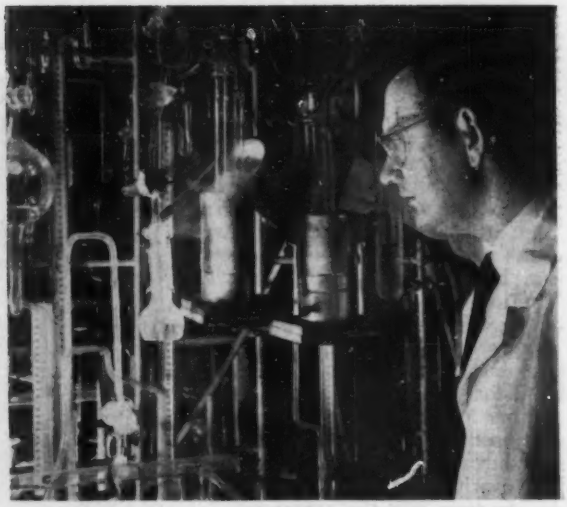
STRIPPING Bullrush ore body of Western Nuclear. This is stage two stripping south of stage one mining. Waste from these two stages is hauled east (top of picture) from the pit. Boatright and Smith are contracting stripping and move an average of 6,500 cubic yards daily. Six Euclid 21-cubic-yard scrapers are used. Scraper at left has only one push tractor, whereas two are normally used. Pit bottom is ripped ahead of loading: Pit slope is carried at 63° with first bench 55 feet below surface. A 40-foot-wide berm is left at bottom of first bench.

DALE B. LEVI COMPANY has developed one of the smaller open-pit mines in the East Gas Hills. Some 50,000 cubic yards were stripped to mine what appears to be a 3,500- to 5,000-ton ore body. It took good prospecting to find this ore body.



WATER is harder to find than uranium in the Gas Hills. Lucky Mc brought in this Texas oil drilling rig to drill for water for its new 750-ton-per-day mill. Three wells are being drilled east of the mill site to a depth of 1,100 feet for mill and camp water.

MINING is the first step in making decaborane, high energy fuel, for air breating engines. This is new open-pit mine of United States Borax and Chemical Corporation.



HIGH ENERGY DECABORANE fuels were developed in the laboratory. This scientist experiments in Olin Mathieson Chemical Corporation's pilot plant at Niagra Falls, New York.

Mining Is First Step in Future Fuels For Rockets and Air Breathing Engines

Mining enters a new jet propelled era in the West. Chemical fuels, sparked by boron, must be mined for air breathing engines. At the same time, mining of hydrocarbons as gasoline sources supplements the traditional pumping of oil.

Boron in High-Energy Fuels Increases Aircraft Range, Speed and Payload

High-energy, exotic fuels for jet planes and missiles are now being turned out on a semi-commercial scale by Olin Mathieson Chemical Company. Both Olin Mathieson and Callery Chemical Company are building large commercial plants to produce these fuels from boron. These new fuels will increase range, speed, and payload of present missiles and jets and, more importantly, will make possible radical new chemical planes.

Production of these boron based fuels is scheduled to increase 20 fold in the next 18 months. Btu's per pound of aircraft fuel equal power, range, and speed. Boron combines with hydrogen to form a high-energy fuel which is easy and safe to handle and can be produced at relatively low cost. For example, one gram of boron burns with 4,000 calories; coal, 8,000; however, decaborane, 10 boron-14 hydrogen, burns with 16,000.

The high-energy fuel breakthrough means increased demands for boron. Fortunately the United States has by far the largest reserves in the world in southern California and Nevada. But, the government, many prospectors, and several large companies don't think these reserves are large enough in view of the growth potentialities of the high-energy fuel. It's a far different story when comparing boron demand at 600,000 tons a few years ago with no one knows what tomorrow.

Therefore, the United States Geological Survey has mapped, surveyed, and drilled areas of the Mojave Desert in recent years looking for more boron. Individuals and companies too are looking. In fact one geologist says that he "would rather find a big boron mine than a uranium mine today."

Boron minerals are: colemanite, $Ca_2B_6O_{11} \cdot 5H_2O$; tincal, $Na_2B_4O_7 \cdot 10H_2O$; kernite or rasorite, $Na_2B_4O_7 \cdot 4H_2O$; and ulexite, $NaCaB_5O_9 \cdot 8H_2O$.

The accompanying map shows where boron has been and is now being mined. In Nevada, small production was made in the 1870's at Teels and Columbus Marshes. In California, boron has been produced in Death Valley at the Harmony Works, Amargosa Works, at the Calico mine, the Lila C. mine, six mines at Ryan, mines at Lang, and the Gerstley mine. However, no ore has been mined since 1928.

Colemanite was discovered in the Kramer district in 1913 and the first shaft sunk in 1926. Mining has been underway continuously since by the United States Borax Company, now a division of United States Borax and Chemical Corporation. Open-pit mining displaced underground mining in June.

The second largest source of boron is the brine of Searles Lake where the American Potash and Chemical Corporation and Stauffer Chemical Company (formerly Westend Chemical Company) recover tincal from the brine.

Death Valley borates occur in Quaternary deposits found in surface layers along the edges of the Death Valley sink. The larger and more important Tertiary deposits are found in bedded sedimentary rocks.

At Kramer boron minerals are found in sedimentary clay beds. They are upper Miocene in age and were laid down in standing water.

Boron has been produced in Argentina, Chile, Peru, and Bolivia from playa and dry lake deposits similar to those of California. Argentina is probably the second largest producer with the Compania Productora de Boratos, S. A's. Tincalayu underground mine a major source.

Turkey has been a boron producer for many years. Output from the Susurluk mine in Susurluk County was 13,730 tons in 1952. Other deposits are known in Bigadic, M. Kemalpasa, and Egridir counties. The recent discovery of a large deposit, 7,000,000 tons developed to date, of colemanite near Kuthaya may well prove to be the world's second largest deposit. The discovery was made while drilling for lignite in a sedimentary basin.

This brief summary shows that boron mines are more scarce than uranium mines were 15 years ago. However, the known mines have very large reserves so no shortage of boron is foreseen. What increased prospecting, if and when demand is great enough, will turn up no one knows.

Good prospecting luck for those of you who are sure that the demand for high-energy fuel parallels the increased power boron gives to aircraft.

Asphalt Ridge Tar Sands May Be Mined On Large Scale for Crude Oil Recovery

Open-pit mining of Utah's oil-saturated Asphalt Ridge sands as a gasoline source looks promising. Standard Oil Company of Ohio's subsidiary, Sohio Petroleum Company, has had two core drills at work blocking out reserves south of Vernal, Utah. The sands, averaging about 100 feet thick, buried by up to 100 feet of overburden, have long been regarded as a potential oil source. Oil content averages about 0.75 barrel per ton of sand. A process has been developed to separate oil from sand which then must be refined by a catalytic cracking plant to produce gasoline and other compounds.

Sohio may have the cost answer in a year's time and if it goes ahead it will mean a big mining job. A 15,000-ton-per-day mine is big, and it will take that much sand ore for an economic 10,000-barrel-per-day refinery.

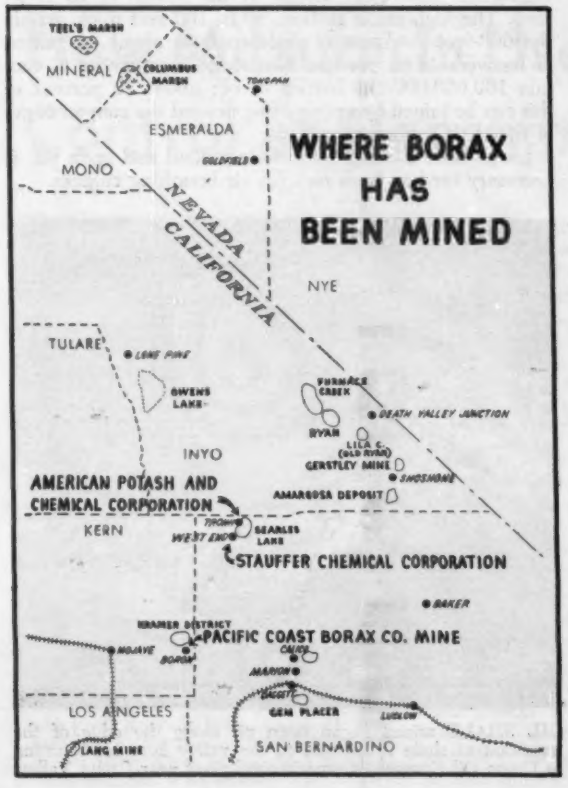
Another mining project for air breathing engine fuel.

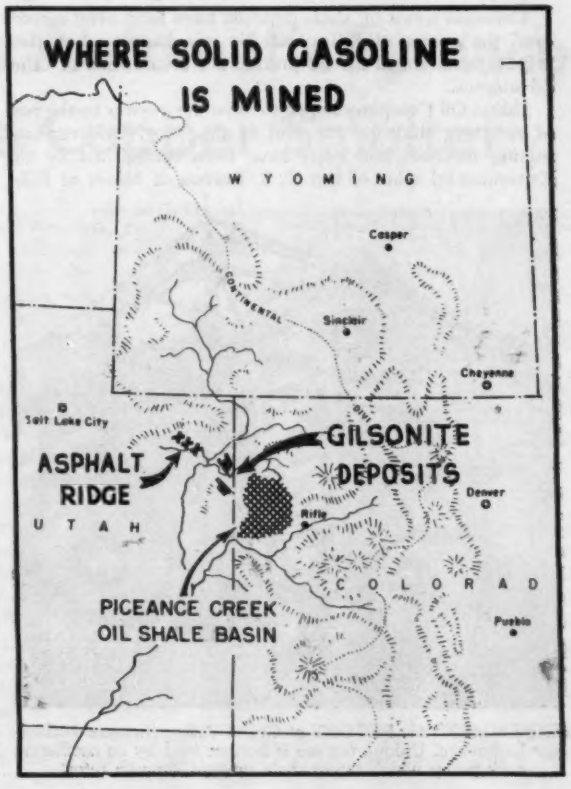
New Underground Mining Methods Make Gasoline from Gilsonite Commercial

New underground mining methods have been perfected to mine solid gasoline–Gilsonite–from veins in eastern Utah. Each ton of the Gilsonite contains 5.5 barrels of crude oil. Each ton of Gilsonite contains 700 pounds of gasoline.

Gasoline from Gilsonite means that more than 100,000,000 barrels of oil can be produced from known Gilsonite veins in the Uinta Basin. This involves a very large underground mining operation–the volume of ore mined each day approximates that mined at a 4,000-ton-per-day copper mine.

American Gilsonite Company is mining this gasoline





CATALYTIC REFORMER unit at American Gilsonite's Grand Junction refinery converts Gilsonite ore to high octane gasoline. Metallurgical coke is important byproduct.

MINING GILSONITE, a solid hydrocarbon containing 35 percent gasoline, at American Gilsonite Company's Cowboy vein in eastern Utah. Hydraulic jet cutter blasts ore from vein.

from vertical veins using high pressure water jet cutters. Every pound of ore mined is crushed underground and pumped to the surface in a water slurry. This slurry is then piped under high pressure 72 miles to an oil refinery near Grand Junction, Colorado.

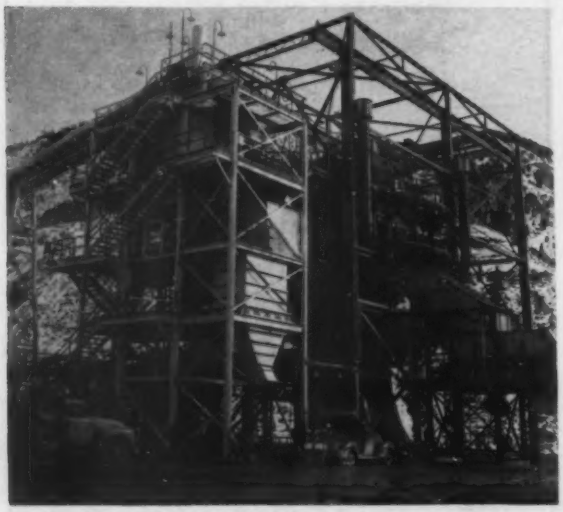
Pumping and pipe lining ore may herald a new era in other mining operations. Certainly the first commercial mining of solid hydrocarbons as a source of gasoline is dramatic proof that mining gains in importance in producing engine fuel.

Union Oil Developes Open Pit Along Canyon Rim To Mine Mahogany Ledge

Colorado's vast oil shale deposits have long been considered the source of future oil. No one knows when they will be economical for oil production in the face of other oil sources.

Union Oil Company hopes to have the answer to the cost of retorting shale by the end of this year. Underground mining methods and costs have been established by the Experimental mine of the U. S. Bureau of Mines at Rifle, Colorado. Union Oil has contracted with Isbell Construction Company for stripping and open-pit mining of the high-grade Mahogany Ledge as the source of its retort feed. The high-grade section, 90 to 100 feet thick, within the 600-foot thickness of shale contains about 32 gallons of recoverable oil per ton. This ledge is estimated to contain 100,000,000,000 barrels of oil; about 10 percent of this can be mined by open pitting around the canyon edges of the shale capped mesas.

Large scale mining, both underground and open pit, is necessary for fuel from rock for air breathing engines.



EXPERIMENTAL RETORT at Grand Valley furnaces Mahogany Ledge ore. Unique feature is bottom feed by an oscillating rock pump which forces shale upward through retort.

OIL SHALE mined in an open pit along the edge of the mountain of shale is lowered to the valley floor for retorting in Union Oil Company's experimental plant near Grand Valley.

NIGHT AT NAOSHIMA copper smelter on a small island in Japan's Inland Sea. The smelter is the only one in the Orient which has a reverberatory furnace. It is the first smelter in the world to recover zinc, by fuming, from copper slag.

How Mitsubishi Uses Automatic Furnace Control at Naoshima Copper Smelter

By SEI ARAKANE

Automatic furnace control, maximum waste heat recovery, and new refractories and their more efficient use have reduced fuel consumption, increased recovery, and lowered cost at the Orient's most efficient copper smelter. It is Mitsubishi Metal Company's Naoshima smelter, named after the small island in the Inland Sea of Japan on which it is built. Naoshima is three kilometers south of Uno port, Okayama Prefecture, Honshu, the main island of Japan.

The smelter, which is equipped with the only copper reverberatory furnace in the Orient, started operation in 1918. Copper concentrates from Mitsubishi mines in Japan, such as Ikuno, Akenobe, Shimokawa, and Makimine, in addition to those from the Toledo mine in the Philippines of Atlas Consolidated Mining and Development Company, are treated.

Currently, Naoshima operates a sulphuric acid plant using the Petersen and Okada systems to treat roaster gases; an arsenic plant for extracting arsenic from copper concentrate; and a zinc fuming plant utilizing copper slag. The zinc plant, which actually was the first in the world, began operating in December 1950.

The completion of the zinc fuming plant enabled the electrolytic zinc plant which was closed during World War II to resume operations, resulting in the successful and profitable recovery of zinc, lead, cadmium, and germanium contained in the copper concentrate.

Features of Smelter

The smelter flowsheet shows the outstanding features. From copper concentrates and copper scrap almost all valuable metallic elements as well as heat (energy) produced in the course of copper smelting are being economically recovered by the applications of a wide range of mechanical control systems.

The smelter charge may roughly be classified into three categories: ores and concentrates having a high per-

Mr. Arakane is now chief metallurgist for the Mitsubishi Metal Mining Company, Ltd. with headquarters in Tokyo, Japan. For several years he was manager of the Naoshima copper smelter where he supervised improvements described in his article.

centage of sulphur, those high in arsenic, and those high in copper. The ratio of these available at the smelter is 40 percent, 4 percent, and 56 percent, respectively.

Ores high in sulphur are roasted to reduce the amount of sulphur in order to form a satisfactory matte in the reverberatory furnace; the SO_2 gas thus produced is utilized to make sulphuric acid. Arsenic oxide is recovered from the material high in arsenic. Then, all these calcines, together with copper concentrates, undergo pyro-metallurgical treatment in the reverberatory furnace for the recovery of gold, silver, and copper.

Blister copper from the converter is made into anodes of good quality by a refining furnace. The anodes are then shipped to the company's Osaka refinery to make electrolytic copper. From converter gas, sulphuric acid is recovered, while the copper slag is fumed for the remaining valuable metallic elements. In addition to the recovery of flue dust, zinc oxide, electrolytic zinc, zinc sulphate, lead, cadmium, and germanium are also recovered from the converter gas by both hydro and pyro-metallurgical treatment.

Table No. I Source, Recovery, and Use for Waste Heat at Mitsubishi Metal Mining Company's Naoshima, Japan Copper Smelter

Heat Source	*Equipment Used*	*To Obtain*	*For*
Reverberatory	Waste heat boiler	Steam	Power generation
Refining furnace	Waste heat boiler	Steam	Plant heat source
Fuming furnace	Waste heat boiler	Steam	Power generation
Fuming furnace[1]	Heat exchanger	High temperature air	Secondary air for fuming furnace
Converter	Heat exchanger	High temperature air	Primary air for reverberatory furnace burner

1. This is hot air from the waste heat boiler which contains some Btu's not recovered in the boiler.

The slag is utilized for manufacture of roofing tiles and bricks. As a result, hardly anything is wasted. Monthly revenue from the sale of byproducts is more than enough to defray the operating expenses of the smelter.

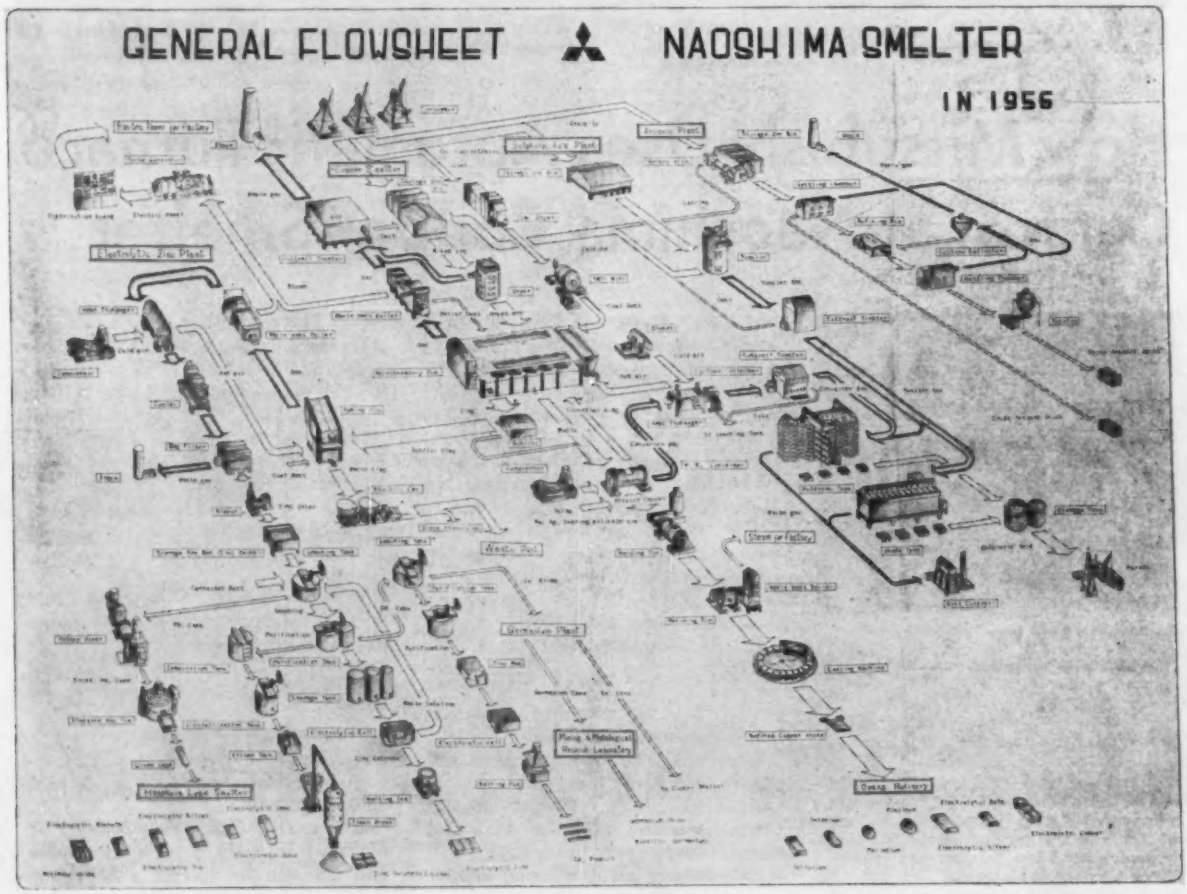
Automatic Heat Control

In every phase of operation a large amount of heat is consumed. The efficient use and conservation of fuel is highly desirable, not only in the control of direct heat energy but in the recovery of waste heat as well. Every effort is made to make use of waste heat with the equipment listed in Table No. I.

For heat recovery, power generators available are: one 3,600-kw unit, two 1,650-kw units, one 1,400-kw unit, and one 700-kw unit. Approximately 40 percent of the total heat for the reverberatory furnace is recovered and made available for power generation, it amounts to 1,500,000 to 1,800,000 kilowatt hours per month.

Each operating process is so closely correlated that it is extremely important to maintain control over each at highest efficiency. To this end, an automatic control system is used for the reverberatory furnace to control the draft, temperatures, and coal ratio. The results have proved very satisfactory and contributed to the effective use of heat.

At the fuming plant, the mechanical control system is applied to the widest possible degree, thus ensuring the suc-



cessful operation under any operating condition.

In the sulphuric acid plant, to cope with the fluctuations involving the recovery of converter gas, a variety of metering instruments are provided for remote control of the gas flow, density, draft, etc. In the sulphuric acid purification tower, the tower pressure is automatically controlled. These controls are largely responsible for the higher recovery of gas, and it is believed that the recovery percentage of sulphur in the smelter feed at Naoshima will probably be among the highest in the world.

Fuel and Combustion Control

Costs of fuel and refractory materials constitute a large portion of all expenses in reverberatory copper smelting. This is of great importance, especially in Japan, where fuel is twice as expensive as it is in the United States.

About 40 percent of waste heat in the reverberatory furnace is recovered by the waste heat boiler. In order to lower the cost of copper smelting, it is most essential to minimize the use of fuel and refractories. To this end, a series of fuel conservation measures and improvement in the use of bricks have been put into practice. Details are discussed below.

Table No. III Comparison of Old and New Silica Brick for Reverberatory Furnace Roof at Mitsubishi Metal Mining Company's Naoshima, Japan Copper Smelter

Chemical Composition Percent	*New*	*Old*
SiO_2	95.57	92.64
Al_2O_3	0.28	1.40
Fe_2O_3	1.86	3.08
CaO	1.70	2.03
MgO	——	0.36
Physical Properties		
Unit weight, kilograms	18	27
Refractoriness (SK)	33	33
Compressive strength, Kilograms per square meter	403	249
Adsorption, percent	9.5	13.8
Porosity, percent	17.3	24.4
Specific gravity	1.90	1.77
Mixed scrap, percentage	———	30

The reverberatory furnace is 25 feet wide and 96 feet long. Pulverized coal is used as fuel and burned in six 6-inch Worford burners. The side walls are of silica brick. The sprung arch roof, which was also of silica until June 1955, is now the horizontal suspended-type of chromite-magnesia brick for the smelting zone and a combination of silica and high duty chamotte for the settling zone.

With the air preheated to about 150° C., a forced burning is effected. The focus under such conditions is some 10 to 12 meters from the burner tip with a maximum temperature of about 1,500° C. Gases leaving the furnace at the temperature of about 1,200° C. are led through the waste heat boiler and the Cottrell plant and exhausted through the stack.

Table No. II How Automatic Control and Better Operations Have Reduced Fuel Consumption at Mitsubishi Metal Mining Company's Naoshima, Japan Copper Smelter

Operating Period	*Kilograms Coal Per Ton of Solid Charge*	*Percent Ratio*	*Remarks*
April 1952 to September 1952	239	100	Load on reverbatory furnace
October 1952 to March 1953	234	98	Heat exchanger set up
April 1952 to September 1953	216	90	Automatic draft control set up
October 1953 to March 1954	197	82	
April 1954 to June 1957	157	66	Automatic combustion control system set up.

Typical draft charts of the reverberatory furnace in operation before controls are shown. Operation was not satisfactory because of:

1. Considerable variation in gas volume due to delayed adjustment of combustion rate.
2. Variation in gas speed through the furnace.
3. Air leakage influence.
4. Resistance in the waste heat boiler and lancing.

These are almost inevitable when controls are operated manually.

Automatic Control System

Of the various measures taken to cut the fuel bill of the reverberatory furnace, the introduction of an automatic control system for draft and combustion stands out as the most important and scientific approach.

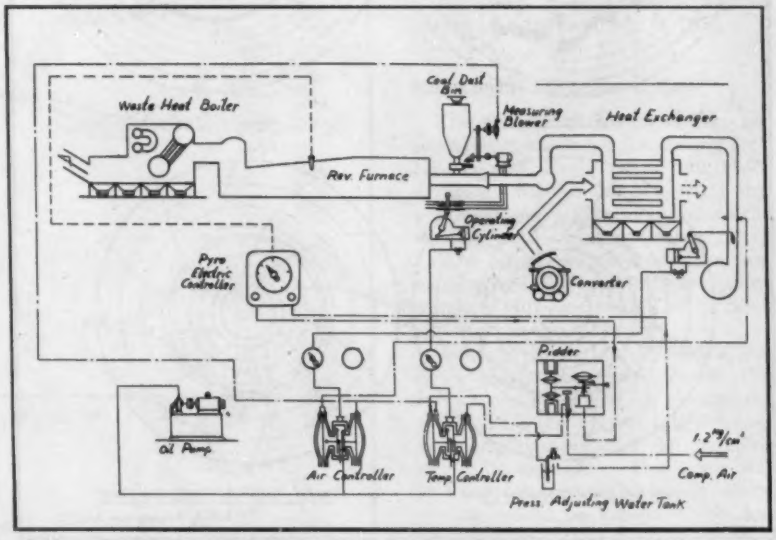
The draft, if operated with a negative pressure, is liable to cause loss in fuel owing to the excessive air leakage. If operated at a positive pressure, however, it is likely to cause incomplete combustion, and will affect the refractories of the furnace besides. Hence, it is necessary to maintain the draft at the proper operating condition throughout.

It is desirable to operate the draft control so that when the furnace temperature drops following the charging of the furnace the fuel and air supply will be increased without delay to facilitate the melting of the charge. Then the supply of fuel and air are lowered successively, and finally to a required minimum low, when the melting in the furnace reaches the high point.

Measuring up to all these requirements, the introduction of full automatic control at Naoshima met with great success. Draft and combustion control systems have been in effect since the spring of 1953 and 1954, respectively, and with improved operational results.

How Draft Control Works

The system incorporates an oil pressure induction tube of the Askania type. The schematic diagram of the draft control system is shown. Control is mostly by the dampers built behind the waste heat boiler. To forestall the excessive fluctuation that might arise, two big exhaust fans are installed at



AUTOMATIC COMBUSTION CONTROL diagram showing pyrometer in reverberatory furnace roof which is key unit. Combustion ratio is controlled by varying speed of coal input to furnace.

the outlet of the Cottrell as shown in the diagram.

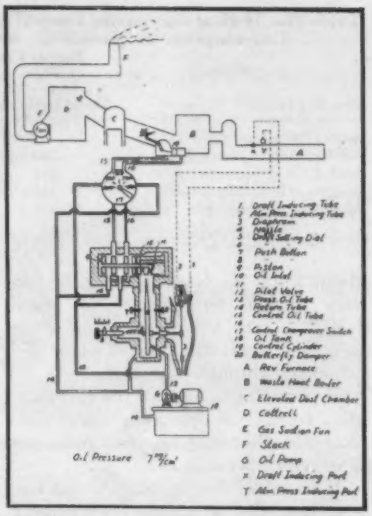
The limit switch operates interlockingly so that the circuits for oil pressure tubes open and close in succession.

The furnace draft, which is the basis for automatic control, is induced from the roof of the reverberatory furnace to the inside of the diaphragm of the draft setting dial, while the atmospheric pressure is induced and brought to the other side of the diaphragm.

The diaphragm, made of sheepskin, is extremely sensitive and responds to the slightest variation of the draft. The sensitivity is 1/100 of a millimeter water column.

The pilot valve, fitted with a piston, opens and closes the connection between the oil pressure tube and two oil inducing tubes leading to the control cylinder. When the jet sways to the right moving the piston to the right, the pilot valve communicates the oil pressure of the pump to the inducing tube at the right and permits the oil to flow. It then returns from the oil inducing tube at the left.

Oil at a pressure of six kilograms per square centimeter flows to the right through the oil inducing tube at the maximum volume of 40 liters per minute to actuate the right side of the control cylinder. Thus, the butterfly dampers set up behind the waste heat boiler begin to function within two seconds. In addition, should the occasion demand, exhaust fans for the Cottrell, installed 180 meters away, complete its functioning in about 25 seconds. Through these operations it is possible to maintain constant furnace pressure and at the same time record the furnace pressure.



DRAFT CONTROL centers in the dampers built behind the waste heat boiler. Constant furnace pressure is maintained.

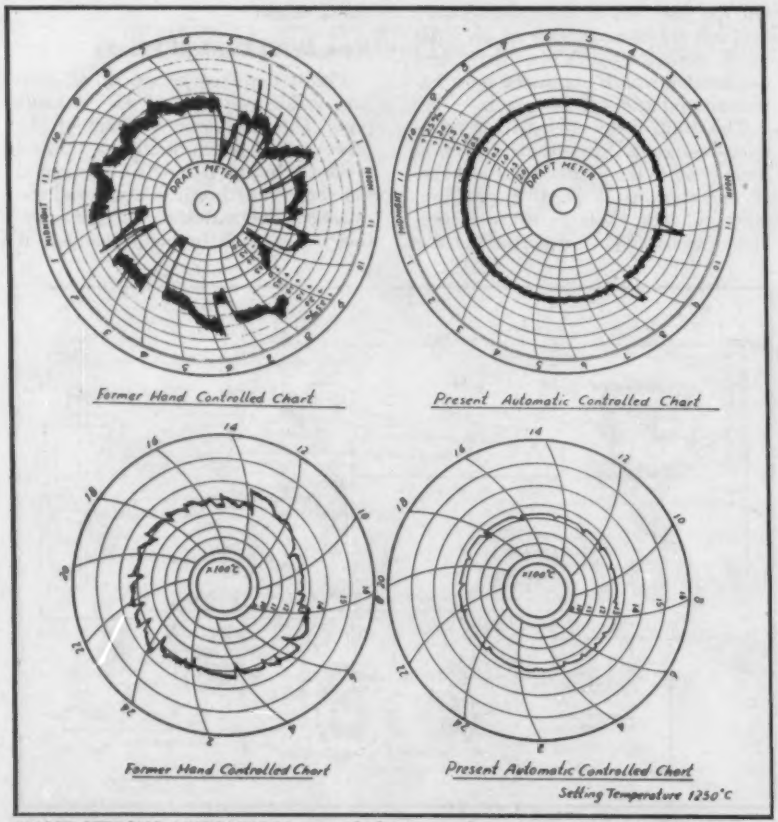
Automatic Combustion Control

The combustion control system is nearly the same as that of the draft described above. The control diagram is shown.

The internal temperature of the furnace roof, some 15 meters from the burner end, is taken as the source for control, and is measured by a radiation pyrometer. The electro-motive force of the Chromel-Constantan thermocouple is amplified in the radiation pyroregulator, and operates the balancing motor, which in turn regulates the revolutions per minute of the screw feeder of the coal burner, thus keeping the amount of air in the proper ratio.

Since the adoption of automatic control, the draft has been maintained within ±0.2 millimeters water column, against the wide fluctuation ranging from minus 3.0 to plus 1.0 millimeters water column of the previous practice. Results of the automatic combustion control are shown in the diagram. Note the furnace temperature began to be restored to normal within five minutes as compared with the 25 to 30 minutes of the previous practice. In addition, the fluctuation of the furnace temperature has been reduced to 30° C. as compared with the previous 50°.

Consequently, the furnace operation has been stabilized and a distinct fuel saving has been effected as indicated in the accompanying Table No. II.



HAND VERSUS AUTOMATIC control charts are shown. Note the violent fluctuations in the furnace draft at top left. Automatic control shows only two variations. The charts at bottom show how temperature change of 200° has been cut to only 65°.

Summarizing the Advantages

1. It is possible to return the draft to the fixed value instantly, regardless of any change in working conditions involving the auxiliary equipment of the reverberatory furnace, boilers, and the Cottrell.
2. Without permitting the temperature drop in the furnace which follows immediately after the introduction of the charge, the melting is facilitated through the increased supply of fuel, and when smelting is activated, less fuel is supplied. As a result, it is possible to cut the fuel consumption to the minimum.
3. By virtue of the recording of accurate figures, it is possible to run the furnace with the Standard Operation Program, enabling the operator to be free from the

Table No. IV Comparisons of Ritex CR-MG Bricks Used for Reverberatory Furnace at Mitsubishi Metal Mining Company's Naoshima, Japan Copper Smelter

Percent	*Ritex A*	*Ritex B*	*Ritex F*	*3R-A*	*MAC-UB35*
SiO_2	6-8	7-8	5-7	6-8	6-9
Al_2O_3	9-11	18-20	14-16	16-18	23-25
Fe_2O_3	8-10	11-13	9-11	10-11	9-12
Cr_2O_3	7-9	22-24	20-22	19-21	19-22
CaO	——	0.7-0.8	0.8-0.9	0.7-0.8	0-2
MgO	61-63	31-33	43-45	43-45	34-36
Porosity, percent	10-13	10-12	8-9	20-21	12-16
Specific gravity	2.9-3.1	3.1	3.11	3.0	3.1-3.2
Compressive strength, kilograms per square centimeter	650-750	——	700-800	750	800-1,200
Softening temperature degrees Centigrade	1,500	1,550	1,542	1,580	1,530-1,570

Table No. V How Better Operations, Automatic Control, and New Refractories Have Prolonged Furnace Life at Mitsubishi Metal Mining Company's Naoshima, Japan Copper Smelter

Operating Period	*Total Operating* Days	*Percent Ratio*	*Concentrate Treated During Period*	*Percent Concentrate Ratio*
April 1950 to October 1952[1]	122	100	42,186	100
November 14, 1952 to May 1, 1953	165	135	68,941	163
May 9, 1953 to November 2, 1953	175	140	71,918	170
November 12, 1953 to June 9, 154	196	166	80,333	190
June 19, 1954 to December 11, 1954	176	141	69,089	164
December 22, 1954 to June 14, 1955	170	139	68,919	163
June 28, 1955 to March 15, 1956	260	213	102,218	243

1. Average

pressure of mechanism and mental strain.

Extension of Furnace Campaign

As already stated, in view of the fact that the reverberatory furnace operation is so indispensably interwoven with other phases of operations in respect to both charge and products, the shut-down of the furnace for repairs stops not only the operation of copper smelting itself but also the waste heat recovery, sulphuric acid recovery from converter gases, and zinc fuming from reverberatory copper slag.

Every effort was made to extend the life of the furnace roof with partial success until 1955. Refractories used for the reverberatory furnace, following United States practice, were silica brick for both walls and sprung arch roof until June 1955. As is well known, silica brick is advantageously used because of its consistency in heat expansion, resistance to rapid changes of temperatures, and high compression strength at high temperature. However, at the operating temperature of about 1,500° C., the brick has to withstand both thermal and chemical attack of high intensity, especially at the flame focus where the failure results.

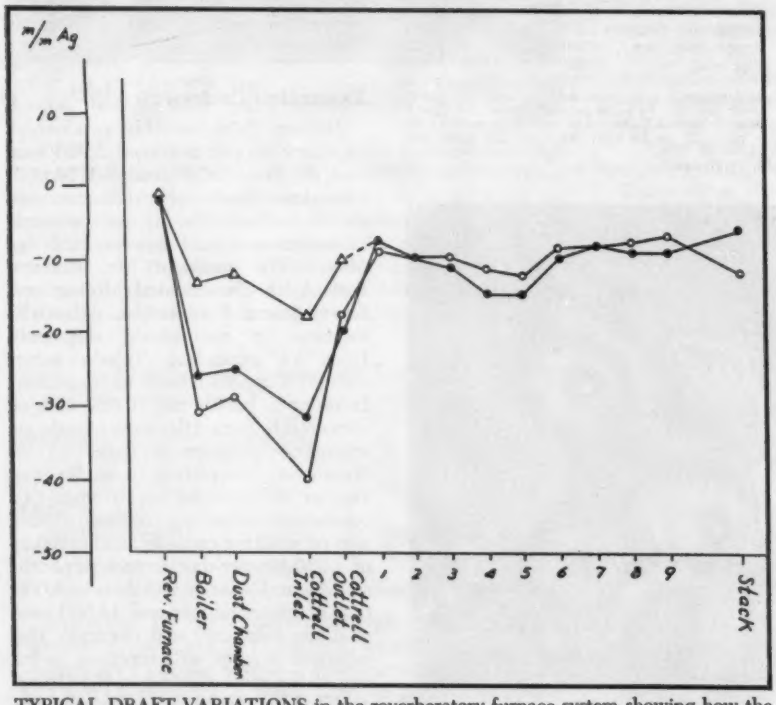
Silica brick, heretofore used for the arch, proved unsatisfactory. Tests were made to develop a new brick. The conclusions thus obtained were: to make the brick of lower porosity with high refractoriness and compression strength. Improvements in physical and chemical properties as shown in Table No. III were essential for more efficient operations.

Improvements in furnace construction were first, with reinforcement by ribbed arch. Ribs 60 centimeters wide and 7.5 high were put in and spaced at a distance of 1.05 meters along the furnace roof covering the flame focus. This gave excellent results in preventing the deformation of the arch. With ribs as a support, better rigidity and strength were imparted. Hot patching and other repairs now can be made much easier.

Because erosion is much faster at the shoulder than at the crown of the arch, a further step was necessary. Thus in 1952 the shoulder of the arch was built in Zebra-type construction using basic Cr-Mg brick and silica brick in layers. Tests proved that Ritex F. was quite satisfactory while Ritex A. was found defective owing to its peeling property. Table No. IV shows the composition of some basic bricks tested.

Application of automatic control proved helpful in prolonging the life of the furnace as a whole.

Table No. V gives the results of improvements from 1952 to 1954.



TYPICAL DRAFT VARIATIONS in the reverberatory furnace system showing how the pressure drops from the reverberatory furnace through the waste heat boiler, the dust chambers, and into the Cottrell unit. Gas pressure raises in the Cottrell and stack.

Horizontal Suspended Roof

The foregoing covers various improvements made for the sprung arch furnace roof. However, in June 1955, a furnace roof of the horizontal suspended-type construction in which the smelting zone was completely made of Cr-Mg brick was adopted. Due precaution was paid to avoid the spalling normally involved with Cr-Mg brick as shown in the diagram.

In construction, both individual and block suspensions were adopted. The former was employed for the melting zone where the erosion might be severe and uneven, and hot patching might be necessary. The latter was selected for the settling zone where erosion would be comparatively less and uniform.

The following shows details of these arrangements.

Roofs	Width In Feet	Length In Feet	Refractories	Size In Inches	Suspension Type
No. 1	25	7.8	Silica	12	Individual
No. 2	25	28.8	Cr-Mg	15	Individual
No. 3	25	14.5	Silica & High duty chamotte	15	Individual
No. 4	25	20.1	Silica	15	Block (Maerg system)

It is expected that these construction improvements will prolong the life of the furnace which will mean a great deal to the Naoshima smelter.

Three sets of Great Falls-type, 10-foot-diameter, converters and a Pierce Smith converter 8.5 feet in diameter and 17.45 feet long with the capacities of 17 and 24 tons of matte, respectively, may also handle copper scrap besides producing blister copper of about 8 and 12 tons, respectively. Special consideration is given to the high recovery of converter gas. Elaborately shaped hoods of high-chrome cast steel are installed so that the attachment of the upper and lower sections is practically complete which prevents both air and gas leakage.

As a result, the average SO_2 concentration increased by some 50 percent, from 6 to 9 percent. Moreover, as described before, through the mechanical control system, the recovery of waste gases has been doubled.

Blister copper is refined in a cylindrical reverberatory furnace and cast into anodes weighing 158 kilograms and containing 99.3 percent copper.

Zinc Fuming Copper Slag

Slag from the copper reverberatory furnace is treated to recover its zinc content. The zinc fuming unit consists of two water-jacketed vertical furnaces, two boilers, two heat exchangers, two air coolers, three bag filters, and two exhaust fans.

To effect the reduction of zinc oxide, pulverized coal is blown into the molten slag through the tuyeres. With the control panel installed near the furnace, the operator can control the entire operation.

The indicators on the panel keep the operator well informed as to the supply conditions of pulverized coal, air pressure and volume, temperature and pressure at the furnace, flue, boilers, heat exchangers, coolers, and baghouse, etc. The zinc fume is collected in the bag filter and pipe-transmitted to the leaching plant some 200 meters away.

Both the zinc oxide from zinc fuming and flue dust from the converter are leached with spent electrolyte and dilute sulphuric acid. Zinc sulphate solution is then filtered off from the insoluble residue. From this sulphate solution iron, arsenic, antimony, copper, cadmium, germanium, cobalt, and a few other dissolved elements are removed in five steps in the purifying processes.

Purified zinc sulphate solution, after proper acidation, is fed to the cells for electrolysis. Metallic zinc, thus obtained, is melted in electric furnaces and cast into shape.

Some purified zinc sulphate is supplied to textile manufacturers. Contained cadmium is made into metallic cadmium by leaching, purification, and electrolysis. Germanium has also been recovered since November 1954. The leached residue is smelted in an electric furnace to produce lead bullion which is sent to the company's Hosokura smelter in northern Japan for further refining.

Some copper ores high in arsenic are roasted in a rotary kiln to recover arsenic as arsenious oxide, after which the calcine is smelted in the reverberatory. The arsenious oxide (92 percent) collects in the settling chamber and is sold as crude oxide or re-sublimed in a reverberatory furnace to make refined grade.

There are two tower system acid plants at Naoshima. The capacities are: Petersen type, 165 tons per day; and Okada type, 150 tons per day.

Monthly output of acid averages about 11,000 tons, of which 6,500 tons are recovered from gases from eight Herreshoff roasters and 4,500 tons from converter gases.

Table No. VI Analyses of Smelter Feed and Metals Produced for Four Months In 1956 at Mitsubishi Metal Mining Company's Naoshima, Japan Copper Smelter

Item	July	Aug.	Sept.	Oct.
Tons material treated[1]	13,354	12,969	11,946	13,392
Copper, blister	2,039	1,995	1,922	2,104
Gold, kilograms	91	71	98	95
Silver, kilograms	2,879	2,669	2,847	2,858
Sulphuric acid, tons[2]	10,398	9,559	10,022	9,806
Zinc, electrolytic tons	357	316	347	320
Zinc sulphate, tons	210	200	220	250
Lead bullion, tons	54	52	50	53
Cadmium, tons	1.4	1.3	1.3	1.3
Germanium, kilograms	2.1	1.5	1.9	3.5
Arsenic oxide, tons	100	100	100	100
Zinc oxide, tons	561	510	471	545

1. Averages 5 to 8 grams gold per ton; 235 grams silver per ton; 16 to 18 percent copper; 0.6 to 0.7 percent lead; 3.5 zinc; 0.01 to 0.02 cadmium; 20 sulphur; 23 to 24 iron; 0.6 Cao; 0.8 Mgo; and 21 to 22 SiO_2.
2. 50°Baume.

CONVERTER AISLE at Naoshima. Note how closely the gas hoods are fitted around the converter to minimize both air and gas leakage. These high-chrome cast steel hoods have given good life. Their use has increase SO_2 content of gas 50 percent.

Expansion Underway

During 1956 monthly production of blister copper averaged 2,000 tons and sulphuric acid averaged 10,000. Complete details of production are shown in Table No. VI. As the result of contracts signed late in 1956 by Mitsubishi's president Mr. Komura with Atlas Consolidated Mining and Development Corporation, Atlas will increase its concentrate shipments from its expanding Toledo mine, Cebu, Philippine Islands to Naoshima. In order to handle the 10,000 tons of concentrate from Atlas each month, an expansion program is underway at Naoshima. Completion is set for November and includes improvements in concentrate unloading facilities, expansion of smelting capacity, and erection of a 220-ton-per-day contact sulphuric acid plant. Capacity will then be 3,000 tons of blister copper and 14,500 tons of dilute sulphuric acid monthly. The enlarged smelter will continue to be one of the most efficient in the Orient as all the mechanical controls described in this article will be used.—

THE END.

High Tension Separation of Scheelite Concentrate Eliminates Roasting Step

By R. E. BARTHELEMY

A recent series of tests in Carpco's research laboratory indicated the feasibility of beneficiating scheelite by means of high tension separation equipment. In contrast to the method in general practice today, which includes removal of the sulphides by flotation, roasting of the scheelite concentrate, and then treating magnetically, the new method only requires drying to approximately 235° F. and then separating by means of high voltage. Laboratory tests show that the Carpco high tension procedure produces a superior grade of scheelite while at the same time permitting recovery of an appreciable tonnage of a clean sulphide byproduct.

RESEARCH LABORATORY at Jacksonville, Florida where Carpco develops high tension separation for many minerals.

Typical results in the field using the flotation-roasting-magnetic separation method on a preconcentrate containing approximately 46 percent tungsten show an initial scheelite concentrate yield of 65 percent WO_3 after flotation. Subsequent roasting and treating magnetically increases the concentrate to 74 percent WO_3, leaving a magnetic reject containing approximately 10 percent WO_3. Table No. I shows typical results obtained by methods in current use.

Table No. I
Flotation–Roast–Magnetic Separation

Product	*Weight Percent*	*Percent WO_3*	*Distribution Percent*
Cleaned scheelite	60.6	74.0	97.7
Flotation and magnetic rejects	39.4	2.6	2.3
Totals	100.0		100.0

Separation by high tension or high voltage yields a scheelite concentrate of 77 percent, as compared with the 74 average from the flotation–roasting–magnetic method, and a WO_3 recovery of better than 98 percent compared with the 97.7 by conventional methods. Further tests, which include recirculating middlings, are underway to secure an even higher grade scheelite product and, consequently, an appreciable increase in recovery of the WO_3.

It is interesting to note that while flotation is very sensitive to the degree of oxidation of sulphides, which, in turn, influence the final grade of the concentrates, the dry, high tension method is as effective on weathered ores as it is on freshly ground ores and can assure a constant high grade of concentrates. Another plus factor of the high tension method is the recovery of an appreciable tonnage of clean sulphide byproduct. This, of course, is completely lost by the roasting required in the conventional method of beneficiating scheelite; furthermore, all the well known inconveniences of sulphur roasting are completely eliminated when high tension equipment is used since drying to approximately 235° F. is the only heating required. Table No. II outlines the laboratory separation obtained using high tension equipment on a concentrate similar to that shown in Table No. I.

Table No. II
High Tension Separation

Product	*Weight Percent*	*Percent WO_3*	*Distribution Percent*
Cleaned scheelite	58.0	77.2	98.2
Cleaned sulphides	42.0	2.0	1.8
Totals	100.0		100.0

The simplicity of this new method indicates the great amount of time, labor, and dollar savings possible. These high tension separators will handle about a 100 pound per hour, per inch of rotor of new scheelite feed. The capital outlay for such high tension equipment, including the accessories needed, is approximately $1,200 per ton, per hour of capacity. This estimate is based on plants producing over 10 tons per hour.

Tests have been conducted on a Carpco Model HP167 which is designed for both laboratory and pilot plant use. The rotor is the same diameter (6 inches) as the larger industrial units, and the width of the feed is 3 inches. This permits us to use any data gained in the laboratory directly for plant operation simply by multiplying the feed rate by the effective width of the separator rolls to be encountered in plant practice.

High voltage or high tension separation involves conveying the minerals into a field where the high voltage discharge is taking place. The minerals which conduct electricity to a degree do not retain enough surface charge to affect them appreciably, and therefore travel off the rotor at a normal trajectory. Minerals which are non-conductive, however, do take on a strong surface charge and are usually pinned by this charge to the grounded rotor; they follow the rotor around and are brushed off. By varying the current discharge and the rotor speed nearly all materials can be separated effectively and economically. Scheelite is classified as a non-magnetic, non-conductor, and is therefore pinned to the rotor, whereas the sulphides (pyrite), being non-magnetic conductors, are thrown and thus accurately separated.

The obvious simplicity and cost savings of the high tension method over the flotation–roast–magnetic separation procedures suggest its wide acceptance within a very short time.

Mr. Barthelemy is director of research, Carpco Research and Engineering, Jacksonville, Florida.

Canadian Hosts for Meeting . . .

THESE ARE CANADIANS who headed committees which made the Congress such a success; from left: H. J. Fraser, president, Falconbridge Nickel Mines; R. W. Diamond, president of Sixth Commonwealth Congress and director of Consolidated Mining and Smelting Company; Marc Boyer, Canadian Department of Mines; and Robert A. Bryce, chairman of the general committee and president of Macassa Mines.

Canada Proudly Displays Its Mineral Industry to Commonwealth Congress

Canada's mighty mineral industry was placed on review for the 500 delegates to the Sixth British Commonwealth Mining and Metallurgical Congress in September. Starting in Vancouver, British Columbia on September 7th the meetings and plant inspections ended some 10,000 miles away and a month later in Halifax, Nova Scotia.

The rich and varied accomplishments of Canadian mining were viewed by engineers from 35 foreign countries who travelled north and east from Vancouver on chartered planes and by special trains.

About 140 delegates flew north to Kitimat (aluminum), Whitehorse and Dawson (gold), Mayo (lead-silver-zinc), Yellowknife (gold), Uranium City (uranium), Lynn Lake (cobalt-nickel-copper), and Flin Flon (lead-zinc-copper-gold) mines, mills, smelters, and refineries.

A special train carried 225 delegates eastward to meet the northern group at Winnipeg, Manitoba. The train's first stops were at Trail, Sullivan, and Kimberley to visit the vast operations of the Consolidated Mining and Smelting Company. Both groups had opportunities to visit the Sudbury nickel mines, Knob Lake iron mines, and Blind River uranium district.

The tours and plant visits were arranged through industry-wide cooperation. Canadians were proud to show their rich and varied technical accomplishments and high degree of efficiency. In turn they were given the opportunity to meet and learn from designers and operators what their achievements have been at mines in other parts of the world.

Canada's mineral industry has been growing at a spectacular rate but nevertheless needs to attract public interest in and engineers to the industry.

The Commonwealth Congress was formed in London, England in 1924 and has since sponsored similar meetings and tours in Canada in 1927, South Africa in 1930, England in 1949, and Australia and New Zealand in 1953. The objectives are to see that all engineers and scientists in the minerals industry have the opportunity to meet and discuss technology and visit and inspect mines and plants in the host country.

There was no question that engineers from all parts of the world, while separated by only a relatively few miles when home, travelled thousands of miles to Vancouver to renew acquaintances.

After Canada the Union of South Africa had the largest delegation, and was followed by Australia, the Rhodesias, and England. Many delegates were on leave or had leave extended to make the tours. A surprising number were partially financing the cost of the trip themselves. All those who could planned to visit mines and plants in the United States before or after the meeting.

MINING WORLD was there to meet and photograph many of the delegates as they registered at Vancouver.

Australia's Key Representatives . . .

MANY WIVES accompanied their husbands from Australia. From left are: J. W. Foots, general manager, Mt. Isa Mines, Ltd., and Mrs. Foots; W. E. Fitzpatrick, deputy assistant manager, North Broken Hill, Ltd., and Mrs. Fitzpatrick; F. C. Stevens, chief engineer, North Broken Hill, and Mrs. Stevens; Dr. J. C. Nixon, chief resident metallurgist, Zinc Corporation Ltd.; and F. L. Hennesy, smelter superintendent, Mt. Morgan, Ltd.

United States Delegates . . .

FROM THE UNITED STATES CAME: N. H. Donald, St. Joseph Lead Company; Charles W. Merrill and Wing Agnew who were official representatives of the U. S. Bureau of Mines.

Gold Miners Get Together . . .

GOLD MINERS: Frank Ludwig, Western Deep Levels, Johannesburg, South Africa; Viola MacMillan, Violamac Mines, Toronto, Canada; and R. H. MacWilliam, Union Corporation, London.

Transvaal Gold Producers . . .

TRANSVAAL GOLD miners included: R. Oxley Oxland, chief explosives engineer, African Explosives; A. C. Langton, assistant manager, Rand Leases Gold Mining Co.; D. R. Human, technical control officer, West Rand Consolidated Mines; and W. P. Pilmington, resident manager, Stilfontein Gold Mining.

Rhodesian Copper Miners . . .

FROM RHODESIAS were: F. L. Amm, geologist, Rhodesian Geological Survey, Salisbury, Southern Rhodesia; W. Ralston, chief government mining engineer, Salisbury; C. A. O'Connell, assistant manager, Mufulira Copper Mines, Ltd., Mufulira; and L. Serfontein, commissioner of mines, Ndola, Northern Rhodesia.

Nigeria . . .

Jamaica . . .

Norway . . .

FROM LEFT ARE: A. C. F. Armstrong, secretary, Lands, Mines, and Power, Lagos, Nigeria; W. P. Gaskell, chief inspector of mines, Jos, Nigeria; Dr. S. A. Vincenz, geologist, Half-Way Tree, Jamaica; V. A. Zans, director, Jamaican Geological Survey; W. K. Brown, commissioner of mines, Jamaica; Lars De Jounge, Sandviken, Sweden; and Carl-Bertil Berglund, chief engineer, Luossavaara-Kirunavaara AB, Kiruna, Sweden.

From All Parts of Africa . . .

GEOLOGISTS and engineers from Africa included: W. G. Payne-Mercier, South African commissioner of mines; C. D. Hallam, geologist for Anglo-American Diamond Mines of South West Africa; J. B. Bocock, consulting engineer, New Consolidated Gold Fields; A. Bensusan, consulting geologist, Salisbury, Southern Rhodesia; J. D. Pollett, director, Geological Department of Sierra Leone; and I. G. Hughes, Geological Survey, Ghana.

United States

Personalities in the News———

Dr. Thomas H. Johnson has resigned his position as director of the Research Division of the United States Atomic Energy Commission to accept a position as manager of the research division of the Raytheon Manufacturing Company in Waltham, Massachusetts. Dr. Johnson has been Research Division director since 1951, and has directed the commission's research programs in the physical sciences. His successor has not yet been named.

Randy Taylor, former assistant chief engineer in the Engineering and Geology Department of Climax Molybdenum Company in Climax, Colorado, will assume duties as mine superintendent of the Duval Sulphur and Potash Company's operations at Carlsbad, New Mexico.

Ben T. Phillips was recently promoted to mine surveyor at International Minerals & Chemical Corporation's Carlsbad, New Mexico plant. Mr. Phillips joined International's staff as a junior engineer in 1956. In his new position he will be responsible for all underground surveying.

James D. Warner was recently promoted to assistant superintendent of Oliver Iron Mining Division's Pioneer underground mine at Ely, Minnesota. Oliver Iron Mining is a divsion of United States Steel Corporation.

Dr. Oscar T. Marzke has accepted a position as vice president in charge of fundamental research for the United States Steel Corporation. Dr. Marzke, who was formerly director of research, U. S. Naval Research Laboratory, is vice chairman of the Institute of Metals Division, American Institute of Mining, Metallurgical and Petroleum Engineers.

Robert S. Atkins, mining engineer at Inland Steel Company's Bristol iron mine at Iron River, Michigan, has been transferred to the company's training group at Indiana Harbor, Indiana.

HARRY L. MILLER, former assistant superintendent of mines, has been promoted to superintendent of the American Zinc Company of Tennessee's operations in Jefferson County, Tennessee. He is pictured at the collar of the Howard shaft of the Young mine in Tennessee. Other supervisory changes made by American Zinc include the promotion of M. J. LANGLEY, former superintendent of mines, to general superintendent and the advancement of former general foreman GLENN HURST to superintendent of Mascot Mine No. 2. R. L. BRITAIN will take over duties as superintendent of the Young Mine. Mr. Britain was previously manager of the company's Mia mines in Nevada. By error, a picture of P. N. MILES, manager of Christensen Diamond Products Company's Mining Sales Division, was published in place of Mr. Miller's in the August issue.

LEWIS S. LOHR is pictured surveying property containing iron ore deposits in Nevada. Mr. Lohr, a recent graduate from the Mackay School of Mines in Reno, Nevada, is now employed with KEITH N. MEADOR, consulting mining geologist in Reno. He is currently engaged in exploration and development of iron properties.

Promotions at United States Lime Products Corporation's Sloan Nevada plant are as follows: **W. E. Ellis** promoted to general superintendent, **George F. Rodrigues** to acting superintendent, and **C. L. Connor** as administrative assistant to the resident manager in Henderson, Nevada.

Roy T. King received the Leo F. Reinartz Scholarship at Carnegie Institute of Technology at Pittsburgh, Pennsylvania for outstanding scholarship and interest in metallurgy. The scholarship was set up by the National Open Hearth Steel Committee of the Iron and Steel Division, The Metallurgical Society, American Institute of Mining, Metallurgical and Petroleum Engineers.

Nicholas P. Veeder is now president of the Granite City Steel Company, Granite City, Illinois. Mr. Veeder was formerly executive vice president.

Thomas Tweed, mining engineer with Inland Steel Company, has been transferred from the engineering department at Ishpeming, Michigan to the company's Bristol iron mine at Crystal Falls, Michigan.

Donald S. Skufca, former mining engineer with Jones & Laughlin Steel Corporation's Michigan Ore Division, has resigned to accept a position with Kennecott Copper Corporation's Ray Mines Division at Hayden, Utah. Another Kennecott appointment is that of **Charles E. Clark, Jr.** as industrial engineer "A" at the Hayden plant. Mr. Clark previously maintained an office as consulting industrial engineer in Whittier, California.

Professor **Charles J. Vitaliano** has undertaken studies of volcanic rock and its relationship to ore mineralization in the Tonopah and Goldfield, Utah area. Professor Vitaliano, staff member of the Indiana University Geology Department, received a grant from the National Science Foundation to carry on his studies.

Warren E. Fenzi, former general superintendent of the Morenci branch of the Phelps Dodge Corporation, is now assistant to the general manager with offices in Douglas, Arizona. **John A. Lentz** will replace Mr. Fenzi at the Morenci branch. Succeeding Mr. Lentz as general superintendent of the New Cornelia Branch at Ajo, Arizona is **James A. Briggs**, former mine superintendent. **Troy B. Hinton** is the new superintendent at New Cornelia.

Nels W. Stalheim has been named to replace **F. A. Fuller** as treasurer of the Rio de Oro Uranium Mines, Incorporated in Albuquerque, New Mexico. Mr. Stalheim was also elected to the company's board of directors, as was **Edward R. Farley**, vice president of the Atlas Corporation. Both men will serve as representatives of the Atlas subsidiary, Hidden Splendor Mining Company.

George W. Wunder has been appointed manager of the newly formed Nuclear Metals Division of National Lead Company. His new position includes responsibilities as vice president and general manager of National Lead Company of Ohio and National Lead Company, Inc., subsidiaries of National Lead Company, operating under contract with the U. S. Atomic Energy Commission installations at Fernald, Ohio, Winchester, Massachusetts, Grand Junction, Colorado, and Monticello, Utah.

William F. Darmitzel has accepted the position of executive director of the New Mexico Mining Association, Santa Fe, New Mexico, replacing **C. H. Murphy** who has retired.

Dr. Charles A. Ransor, chief of the ore procurement branch of the mining division of the U. S. Atomic Energy Commission Grand Junction Operations office; **Robert H. Toole**, chief of leasing and development, mining division; **Philip H. Dodd**, staff engineer with the Director of Exploration Division, and **Pauline G. Fahey**, administrative assistant in the Concentrate Procurement Division, received cash awards for outstanding work performances and money-saving suggestions.

Dr. Charles W. Haynes is now associate professor and head of the Metallurgical Engineering Department at Montana School of Mines in Butte, Montana. Before joining the School of Mines staff, Dr. Haynes was employed as senior research engineer for Autonetics Corporation in Downey, California.

Continued on page 109

J. B. O'CONNOR, president of Dresser Industries, Incorporated in Dallas, Texas, recently toured mining operations in Europe and the Middle East. Included in his trip was the formal opening of a modern mill for processing high-grade barite on the Greek Island of Mykonos. Barite mined and milled on the island will be processed by Magnet Cove Barium Corporation for use by oil drillers in the Middle East, Europe, and North Africa.

Newsmakers in International Mining

JAWAHRALAL NEHRU, Prime Minister of India, spent four days in Sweden during the latter part of June. During his visit he toured mines and manufacturing plants. He is pictured here (left) as he personally tests a rock drill in the test mine of Atlas Copco AB. in Nacka, Sweden. Mr. Nehru toured the entire Atlas plant and also visited the Sandvik Coromant Works where he saw the manufacture of tungsten carbide drill steels.

G. G. Stanley, former metallurgist for Marievale Consolidated Mines, Ltd. in Transvaal, Union of South Africa, is now employed by Geduld Proprietary Mines, Ltd., Transvaal.

Ola Holtan recently resigned his position as mining engineer at the Ore Dressing Laboratory, Technical University of Norway at Trondheim, to accept a position as research engineer at the Department of Mining and Metallurgy, University of Alberta, Canada.

Mario Spado, former metallurgist with the Societe des Mines de Zellidza, in Morocco, North Africa, is now serving with the research laboratory of Ecole de Geologie in Nancy, France as manager of the Ore Dressing Department.

Gailen T. Vandel is now associated with the Metallurgical Department of the Marcona Mining Company as coordinator for expansion, with headquarters in San Francisco, California. Mr. Vandel was previously superintendent of concentrators for the Cerro de Pasco Corporation's operations in Peru.

J. P. Morgan, a staff member of the Department of Mining, Metallurgy and Chemistry of the University of Adelaide at Adelaide, Australia, recently toured underground mines in northern Michigan to make a study of hoisting cables.

Donald F. Fairweather, underground mining manager for Broken Hill South, Ltd. in New South Wales, Australia, was a recent visitor to the Marquette Iron Range in Michigan, observing underground mining methods.

N. E. Nilsen, chief general manager of the Loloma (Fiji) Gold Mines, N.L., in Melbourne, Australia, arrived in the United States recently, accompanied by Mrs. Nilsen, for graduation ceremonies of their son, John, a mining engineer at the Michigan College of Mining & Technology. While in the United States, Mr. Nilsen visited iron mines on the Marquette Iron Range in Michigan, observing mining methods, ore processing and hoisting plants.

Robert Winters, former federal minister of Public Works for Canada, has accepted the position of president of the Rio Tinto Mining Company of Canada. **J. N. V. Duncan**, outgoing president, will remain on the company's board of directors. Mr. Duncan is also managing director of the Rio Tinto Company of London, England.

S. Spiro, a manager of the Anglo American Corporation, has been named to succeed **H. Oppenheimer** as chairman of the Anglo American group of African Free State mining companies. Mr. Oppenheimer will remain on the company's board of directors.

Jack Harris, mine superintendent of the Eastern Mining and Metals Company Limited's Dungun Mines in Bukit Besi, Dungun, Trengganu, Malaya, was the first American to receive the Meritorius Service Medal awarded by the State of Trengganu. Mr. Harris has been at the Dungun Mines since 1949, serving as mining engineer until his promotion to mine superintendent in 1953.

Donald A. Ricketts and **Philip J. Hickey** have been named to the posts of general superintendent and assistant general superintendent, respectively, of the Sierra Division of Cerro de Pasco Corporation in central Peru. Mr. Ricketts has been employed by Cerro de Pasco for 21 years, and Mr. Hickey joined the company in 1941.

James Reid, former assistant manager of Roan Antelope Copper Mines in Luanshya, Northern Rhodesia, was recently promoted to manger of the company.

P. C. Jain, mining engineer, has returned to India after spending three and one half years in Australia. While in Australia, Mr. Jain was associated with Mt. Isa Mines Ltd., Lake George Mines, and Broken Hill South, Ltd.

F. W. Archibald, former assistant manager of American Smelting and Refining Company's Tacoma, Washington smelter, is now smelter superintendent of the Southern Peru Copper Corporation at Ilo, Peru.

W. I. Spence, manager of Messina Transvaal Development Company in Northern Transvaal, Africa, and **D. MacDonald**, resident engineer of the company, recently toured mining operations in the African Copperbelt district.

E. W. HUNT, former mine engineer with Roan Antelope Copper Mines, Ltd. in Northern Rhodesia and more recently serving as consulting engineer with the O'okiep Copper Company, Ltd. in Namaqualand, Union of South Africa, has been transferred to O'okiep's New York offices. The O'okiep Company is a subsidiary of Newmont Mining Corporation.

COLIN NIGHTINGALE (left) is now manager of Ndola Copper Refineries, Ltd. in Northern Rhodesia, where construction is in progress to double the refinery's present capacity. The first section of the copper refinery is expected to be ready for operation in March 1958. Mr. Nightingale was formerly associated with Anglo-Iranian Oil Company, and more recently, mechanical engineer for Mufulira Mines, Ltd. Metallurgical superintendent of the operation is NORMAN WRIGHT, former assistant smelter superintendent at Roan Antelope Copper Mines Ltd. at Luansha, Northern Rhodesia. Ndola Copper Refineries is a subsidiary of Roan Antelope Copper Mines.

Robert Guggenheim, secretary and vice president of the United States Zinc Company and member of American Smelting and Refining Company's executive committee, has been in Sydney, Australia on a holiday trip.

John N. Botsford is now general manager of Gunnar Mines Ltd., Toronto, Canada. Mr. Botsford was formerly manager of the company's Beaverlodge mine and will be succeeded there by **Robert R. Basserman**. Mr. Basserman took part in the early underground operations at Howey Gold Mines and more recently managed operations in northwestern Quebec.

Dr. C. Friedlaender has resigned his position as chief geologist with Chartered Exploration, Ltd., Lusaka, Northern Rhodesia, to accept an appointment as head of the Department of Geology of Dalhousie University, Halifax, Nova Scotia.

J. Wilfred Spooner will replace **Philip T. Kelly** as Minister of Mines in the Ontario Department of Mines. Mr. Spooner was formerly mayor of Timmins, Ontario, Canada and has served as president of the Ontario Municipal Association, as well as chairman of the Association of Mining Municipalities. Mr. Kelly will give his full attention to publishing a newspaper in Kapuskasing, Canada.

Paul F. Karrow has been named to succeed **A. K. Watt** on the geological staff of the Ontario Department of Mines. Mr. Karrow will specialize in Pleistocene and Palaeozoic geology. Mr. Watt has been transferred to the newly formed Water Resources Commission.

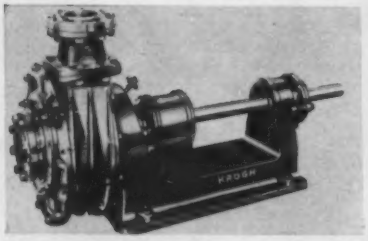
T. A. Barnes has been appointed director of mines, South Australia following the resignation of **S. B. Dickenson**. His former position as deputy director of mines and deputy government geologist will be filled by **L. W. Parkin**.

PRODUCTION EQUIPMENT PREVIEW

PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill or smelter. This PEP section is MINING WORLD's way of making available to you some of the finest current information on mechanization.

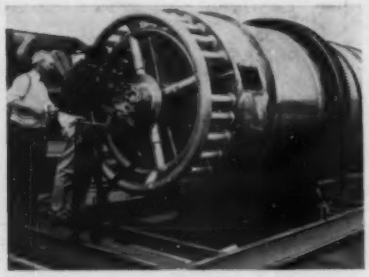
37 Pound Core Drill Has 200 Foot Capacity

The recent development of a 37 pound diamond core and blast hole drill is announced by Wink Corporation. According to the manufacturer, the unit is capable of drilling up to 200 feet. With the use of an overhead drive principle, maximum 10-foot runs are practical. A five horsepower, two-cycle, gasoline engine with vacuum carburetion allows drilling from any angle. Maximum bit speed is 1830 rpm. For hard rock, and deep holes a mechanical advantage lever is available for applying pressure. A similar air operated drill is also available. For additional information on this lightweight unit circle No. 57.



Metal or Rubber Lined Sand and Slurry Pumps

The above photograph shows a new design in sand and slurry pumps. The Krogh Model 600 is a heavy-duty full-lined sand and slurry pump equipped with wear-resistant liners, replaceable and interchangeable with either hard metal or rubber. This flexibility makes the pump suitable for many types of slurry pumping problems or allows it to accommodate changes in operating conditions without expensive pump modifications or installation charges. The pumps range in size from two inches to eight inches with capacities from 20 to 2000 gpm up to 100 feet head or more. Write for additional information to: Krogh Pump and Equipment Co., Inc., 515 Harrison St., San Francisco 5, California. Use the handy reader service card.

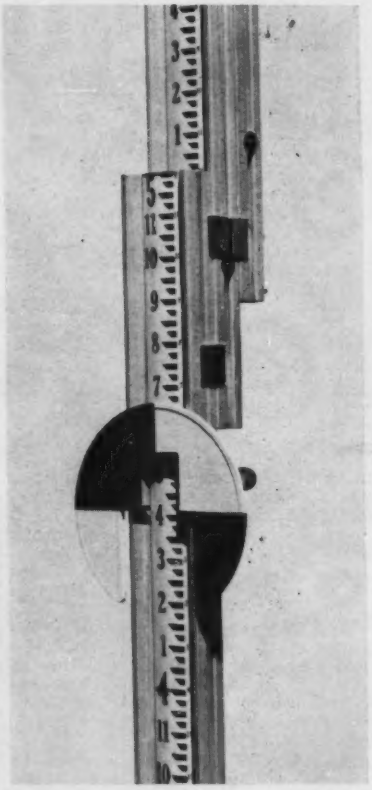


All-Welded Aluminum Steam Tube Dryers

Equipment costs have been significantly lowered through the use of aluminum in constructing this all-welded aluminum steam dryer. Manufactured by Standard Steel Company of Los Angeles, the dryer is all aluminum except for the tires, driving gears, trunnion roll assemblies and bed frame; the dryers are constructed entirely of aluminum with stainless steel pads separating the dissimilar metals to prevent electrolytic corrosion. For additional information on rotary dryers of this type write the company at 5001 South Boyle Ave., Los Angeles 58, California.

New DuPont Air Sampler Powered by Freon Gas

A new jet air sampler, with no moving parts, is powered by a small container of Du Pont "Freon" propellent. The unit is compact enough to be held in one hand, yet does the same job that heretofore required a bulky hand-operated air pump and dry gas meter. "Freon" passes through a venturi jet inside hexagonal metal aspirator, creating a vacuum in the glass impinger, and sucking the air to be sampled into impinger through fluted tube opening at top. Air bubbles through test liquid in bottom of impinger and this liquid is analyzed after test to determine presence of contaminants in the sampled air. Use reader service card, and write Du Pont Company, Wilmington 98, Delaware, for further information.



New Five-Foot Rod Extends to 14 Feet

A new engineers' rod and target, made of three pieces of selected, seasoned magnolia wood which is light and strong and will not warp, has been introduced by the David White instrument company. Ideal for underground, as well as surface use, the rod is 2¾ inches wide, 1⅛ inches thick, and only five feet long. Fully extended at 14 feet, the rod is constructed so that the white face is curved to prevent reflections. The rod extends easily and locks in any position with unique internal clamping device. For additional data circle No. 60.

SLUSHER BLOCKS: The Paul E. Keeney Co., 1125 S.E. Grand Ave., Portland, Oregon, has available for you literature on the complete line of Rope Master Slusher Blocks. Use the reader service card to write for literature on these husky mining blocks.

SPECTROCHEMICAL ANALYSIS: An informative 28-page illustrated reference brochure is available for you from the Jarrell-Ash Co., describing the basic fundamentals of spectrochemical analysis, including a bibliography of reference material of value to spectrochemical analysis. For your free copy circle No. 4.

DRAGLINE BUCKET CATALOG, published by the Page Engineering Co. is now available. The catalog illustrates and describes the new lightweight, low cost Page "A" Series Automatic Dragline Bucket. Circle No. 6 for a copy.

GEAR SPRAY EQUIPMENT: New Versatal gear spray equipment, which according to the company is designed to accomplish a dangerous lubrication problem with safety and with a savings of up to 80% of gear lubricant, with no shutdown, has been introduced by the Alemite Division of Stewart Warner Corp. Circle No. 7 for the full story.

HARD-FACING BROCHURE: Write to Stoody Co., Whittier, California, for a copy of their new folder describing the hard-facing wires for semi-automatic applications. It contains data on welding characteristics, suggested uses of the 11 wires listed and general information on the semi-automatic process.

ACID LEACH FLOWSHEET, description of Kerr-McGee uranium recovery operations at Shiprock, New Mexico, are featured in Vol. 21, No. 1 of Deco "Trefoil". You may obtain a copy from Denver Equipment Company, 1400 17th, Denver, Colorado.

TC CORE BIT: Hoffman Bros. Drilling Co. have recently developed a new tungsten carbide saw tooth core bit. According to the company, the bit is excellent for the drilling of sandstone, shale, limestone, and similar types of rock. This economical bit works like a saw, yet operates on a conventional drill rig to bring up smooth cores. Circle No. 8 for the full story.

BATTERY POWER: A new publication, the revision of a complete reference catalog on motive-power batteries, discusses important new features of Exide-Ironclad batteries used in mine vehicles. Circle No. 18 for your copy.

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SPEED REDUCER BULLETIN: The Falk Corporation have recently published a new bulletin with complete information on the company's lines of concentric shaft and right angle speed reducers for applications up to 140 hp. Horsepower and troque ratings are given, as well as dimensions, overhung load and thrust capacities, and application pictures. Circle No. 9 for your copy.

PORTABLE HOISTS: A new booklet describing Joy Single Drum Multi-Purpose Portable Hoists has been published by the Joy Manufacturing Co., Oliver Bldg., Pittsburgh 22, Pa. The booklet describes the Joy line of air, electric, and gasoline driven models, in sizes from 0.9 to 15 hp. Write to the company for your copy.

BIT GRINDING: Leaflet E-589, "How to regrind Sandvik Coromant detachable bits," is a new publication of the Atlas Copco Companies. In a series of 14 close-up photos, bit users are shown when and how to sharpen the tungsten carbide bit inserts and gauge surfaces. For your copy write Atlas Copco Pacific Inc., 930 Brittan Avenue, San Carlos, Calif.

VHS DRAGLINE, made from a new grade of steel for wire rope, is at least 15% stronger than Improved Plow Steel, according to the Hazard Wire Rope Division, American Chain and Cable Co., which also claims over double the amount of life for this wire rope, than obtained from Improved Plow Steel draglines. For further information and free bulletin circle No. 10.

REPLACEABLE DIGGER TEETH: Allied Steel & Tractor Products, Inc., have now available universal type alloy steel teeth which fit a variety of equipment. A universal adapter is welded on old tooth, and new tooth is simply fitted into adapter with two locking pins. Circle No. 13 for further information.

OBTAIN LONGER V-BELT LIFE: Simple precautions to prolong the life of V-belts, increase drive efficiency and thereby assure full continuous production are contained in a new 12-page bulletin released by Allis-Chalmers Manufacturing Co. For a copy, write to company at Milwaukee 1, Wisconsin for booklet 20X6234C.

CONCRETE GUN: The Air Placement Equipment Co. have developed a new concrete grouter featuring air agitation of mix, ease of handling, low air requirements, and variable pressure control. Circle No. 16 for further information on this unit, and other Airplaco equipment.

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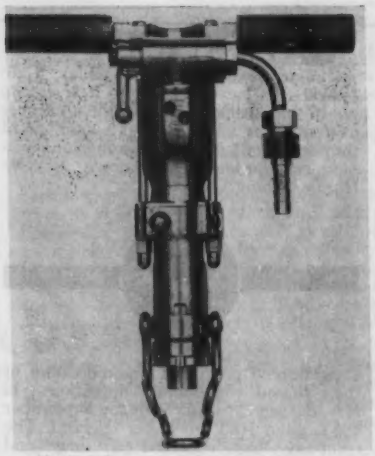
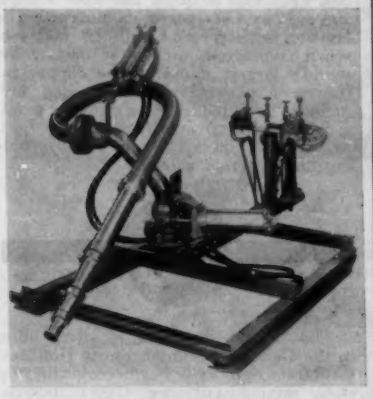


Lightweight Rock Drill Added to Copco Line

A new lightweight, flexible-purpose rock drill designated the BBD-11LH has been added by the Atlas Copco companies to their expanding line of construction and mining equipment. Weighing only 23 pounds and utilizing Copco's light ¾-inch drill steels, the new machine is ideally suited for a wide range of drilling assignments. Quick addition of a standard Copco BMK-51 pusher leg converts the unit for light drifting work as well. For additional information write the company at 930 Brittan Ave., San Carlos, California.

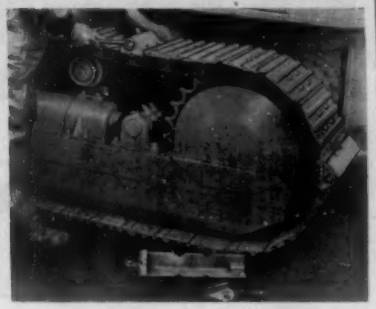
Air Sump Pump Has Larger Capacity and Higher Head

A new pneumatic sump pump, the model VP-8, has just been announced by Gardner-Denver Co., Quincy, Illinois. According to the manufacturer, it is designed specifically to meet the demand for an air-driven pump of larger capacity and higher head. The new pump has a capacity of 250 gpm and handles heads up to 280 feet. Company engineers explain that the pump is designed with intake above the broad, flat bottom that rests in the mud during the operation. Thus, the pump won't bury itself. The model VP-8 is 24 inches high, weighs 110 pounds and will enter an opening up to 11 by 13-inches. Contact company with reader service card for more information.



Chiksan Introduces New Intelli-Giant Monitor

The Chiksan Company, Brea, California, have enlarged their line of hydraulic monitors with the addition of a new three-inch model. The monitor possesses all the simplicity of design of the larger four and six-inch models, and completes a full range of sizes designed to meet most hydraulicking and washing needs. The patented barrel design of this powerful unit, sharply checks friction loss and provides great ease of handling. Even when operated manually this new "Intelli-Giant" may easily be controlled with one hand at water pressures of 30 to 300 pounds per square inch. Write the company using reader service card for additional information.



New Detachable Grousers Increase Loader Output

A new type of removable grouser, which bolts onto the street shoes of Case Terra-Trac crawler tractor-shovels is announced by J. I. Case Co., Racine, Wisconsin. Available for the new larger capacity 1½ and two cubic yard models, the grousers are said to greatly improve traction when working in mud, sand, or on steep slopes. Set of 10 grousers (five for each track) can be attached with a hand wrench in 10 minutes, and the manufacturer claims the units will increase tractor-shovel production up to 30% in slippery going. Special triangular design is said to prevent dirt from packing in back of grousers, thus assuring good traction even in sticky mud. Use reader service card to write manufacturer for further information.

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ARIZONA

Western Gold & Uranium Inc. has acquired all of the assets of *Golden Crown Mining Company*, owner and operator of the *Orphan* uranium mine in the Grand Canyon of Arizona. The Orphan, located 1,100 feet below the South Rim of the Canyon, came into production a year ago. A deep drilling program is in progress to determine magnitude of the ore body. Western Gold operates uranium-silver mines, together with a mill, in the Silver Reef area near Leeds, Utah. It also holds a large alunite deposit near Marysvale, Utah.

Kennecott Copper Corporation's Ray Mines Division is conducting tests to determine design work for expansion of the Hayden mill at Ray, Arizona. Fagergren mechanical flotation cells and Callow cells of the type now used at the mill are being operated side by side in a test section to determine the relative efficiency and cost of each type. A 30-inch cyclone was recently received from *Equipment Engineers Inc.* on a loan basis and installed for tests. This cyclone will be tested in open circuit classifications on the rod mill discharge product of the No. 3 mill section. If tests are successful, the flow sheet for the new grinding section of the mill will be modified for cyclone installations in place of conventional bowl and bowl drag classifiers.

U. S. Consolidated Mines, Inc. of Prescott, Arizona, is entering the building stone business following the acquisition of a large deposit of Moenkopi rock, a colorful stone in demand for modern architecture. The franchise with the wholesale distributor in Southern California is said to call for initial deliveries of 500 tons a month. U. S. Consolidated will conduct this new venture in addition to its manganese and copper operations. Eugene A. Fredericks is company president.

A group of Midland, Texas oilmen have formed *Calizona Mining Company Inc.* at Tucson, Arizona, and are proceeding with a survey of 32 optioned claims in the Twin Buttes area of Arizona. The property leased adjoins part of the Papago Indian Reservation where *American Smelting and Refining Company* recently paid over $1,000,000 for exclusive prospecting rights. Calizona has started geophysical surveying after preliminary drilling showed mineralization. The firm is also active in the Mineral Hill mining district of Pima County, 25 miles southwest of Tucson.

Sevier Minerals Corporation, Kingman, Arizona, has completed a 50-ton flotation mill at the *Gem* mine for production of lead and zinc concentrates. The mill consists of a jaw crusher, secondary gyratory crusher, ball mill, jig in the grinding circuit, lead cells, zinc cells, and a scavenger cell with two-product filters. The mill is running on dump material. Wm. Howard is manager; Wm. L. Kern, assayer.

Construction of *Kennecott Copper Corporation's* new smelter at Hayden, Arizona is making good progress and should open in May 1958 unless there is difficulty in obtaining certain steel items. *Western-Knapp Engineering Company* of San Francisco is doing the work for the *Ray Mines Division* of Kennecott. The Hayden smelter stack will be 600 feet when completed, making it one of the world's largest stacks in the copper industry. Expansion at the Hayden mill includes new track, a new crushing plant, a 2,200-foot conveyor, ore storage bins, and 50 percent expansion in mill grinding and flotation capacity.

CALIFORNIA

The famous lost Spanish silver mine in the Gabillan Mountains near Hollister, California reportedly has been located by state mining engineer Oliver Bowen. Prospectors have searched for the mine for 150 years. It was started by the padres of the Franciscan order to supply silver for ornaments and religious medals at the San Carlos Borremeo Mission at Carmel. Location of the mine has been unknown since 1852 when John Fremont moved into Monterey. Rather than give it up, the Franciscans closed it. Mr. Bowen stumbled on the mine while searching for lime for a cement manufacturer. He is reported to have found several hundred tons of rich silver tailing. The owner of the property did not know the mine existed.

Harold Hawn of Grass Valley, California, who has operated the *Kate Hardy* gold mine in Sierra County for a number of years, has now grouped a number of properties adjoining the mine under a new corporation to be known as *Kate Hardy Mining Company*.

NEVADA

Additional details of the reopening of the *Round Mountain* operations in Nevada (see MINING WORLD, September 1957, page 107) are being released. The company has obtained a new and amended lease from *Nevada Porphyry Gold Mines Inc.* which lasts until July 15, 1967, but may be extended for an additional 15-year period at the option of the lessee. *Morrison-Knudsen* is using twenty 25-ton Euclid trucks to haul the overburden and two 3-yard shovels are used in stripping. MK is to remove 33,155,000 cubic yards of overburden and 38,722,000 yards of material to be processed in the remodeled milling plant which has a planned capacity of 250,000 cubic yards per month. The *Fresnillo Company* now owns all of the stock of *Round Mountain Dredging*.

Inspiration Lead Company of Spokane, Washington proposes to spend $250,000

Compressed Air Process Employed by Petaca

In the high country west of Taos, New Mexico, Petaca Mining Company has expectations of becoming an important producer of ground mica by using compressed air to pulverize and classify the mica to exact particle size specifications demanded by the building trades. Petaca, through its plant pictured above, is one of four mica processing companies using compressed air for fine grinding. The process is considered superior to others in use because there is no "iron contamination." In the compressed air process, mica is mined, processed, and fed to a pulverizing and classification system at minus-½-inch, and plus-18 mesh which produces various closely controlled end particle sizes. A Majac jet pulverizer, a fluid energy mill system, does the job of air pulverization and classification. The wet or dry mica to be processed is fed by a screw feeder into the pulverizing chamber where the mica is impacted against itself, while entrained in two directly opposed, high velocity, streams of air. The mica is then carried to a classification section above the grinding chamber which provides precise control of the end product by controlling the rotational speed of the classifier blades and the amount of fan air introduced in this section, so only particles of suitable size are discharged from the mill. The wet mica is dried by means of the contained heat and moisture-carrying capacity of the air. After discharge from the mill, the mica is conveyed (still in air suspension) to a collection system, and deposited in appropriate end-product bins. The Petaca operation has a capacity of 90 tons of mica per 24 hour period. The Majac jet accomplishes this with power provided by 2,500 cubic feet per minute of free air compressed to 100 pounds per square inch, heated to 800° F, and then distributed at these conditions to the entrance of the two opposing high pressure nozzles.

to resume production at the Nevada gold property of *Dayton Consolidated Mines Company*, closed in World War II. The money owuld be raised through assessments on Class A shares. E. H. Carlson is president of Inspiration.

Kollsman Mineral and Chemical Corporation is now producing quicksilver from its *B & B* mine in Fishlake Valley, Esmeralda County, Nevada. Operations were delayed somewhat by the difficulty in getting delivery of mill and retorting equipment. Trial runs have indicated that the firm will be able to handle large tonnages at extremely low operating and mining costs.

White Caps Gold Mining Company has completed dewatering of the old *White Caps* mine shaft near Manhattan, Nevada and rehabilitation of the various levels. Extensive diamond drilling is planned to block out an ore body located below the 800-foot level. The operators also located antimony assaying in excess of 60 percent at the 300-level, and a 4-inch streak of quicksilver in the same area.

Consolidated Coppermines Corporation is installing a skip hoist at its *Tripp* open-pit copper mine at Kimberly, Nevada. Operation is scheduled for April 1, 1958. Ore and waste from the pit will be loaded into 25-ton-capacity skips, and hoisted to the top of the skipway headframe. It will then be dumped automatically into bins in the headframe, from which ore is fed into railroad cars for an 18-mile trip to McGill concentrator. *National Iron Company* of Duluth, Minnesota designed the hoist to handle 1,000 tons per hour.

The Nevada Bureau of Mines is making a special survey for new mineral deposits in Lincoln County, Nevada. The U. S. Geological Survey will cooperate on a geological survey of the county and other special areas. Results will not be known for a number of years. Reason for the survey is said to be the emergency conditions which have developed because of the closing of the Tempiute and Pioche mining regions. The latter were affected by current low metal prices. The survey will be directed toward locating industrial mineral deposits rather than metal deposits. It is hoped that availabili'y of cheap power, railroad transportation, and a good labor market will attract other mining companies if suitable deposits can be found.

During a recent shutdown, the *Nevada Mines Division of Kennecott Copper Corporation* accomplished some needed repair and preventative maintenance work. One of the main achievements was the replacement of the old rotary dumper at the mill which had been in use since 1932. During the course of its life it had dumped about 143,651,000 tons of ore. At the smelter, a new rubber lined 19-inch skimming pipe was installed which will resist the abrasive action of material in the water which flows through the pipe and granulates and carries the slag to the disposal area.

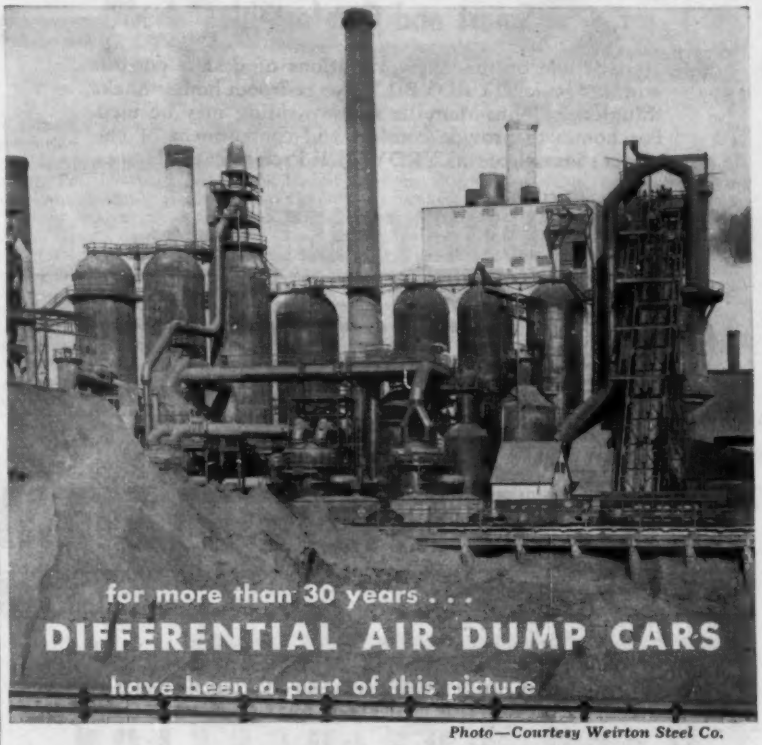
Nevada-Massachusetts Company has made a second cutback in operations at its tungsten mines and processing plant on Pershing County, Nevada. Failure of Congress to appropriate funds to continue the purchase of domestic tungsten was again cited as the reason. From a peak capacity payroll of 275 men, the current payroll has been reduced to 75 men.

Wah Chang Mining Corporation has closed its *Lincoln* tungsten mine and mill at Tempiute, Nevada because of the failure of congress to appropriate funds for the purchase of tungsten under Public Law #733.

NEW MEXICO

Paradox Minerals has leased claims on 3,040 acres of land in the Grants area of New Mexico. A total of 480 acres of fee minerals have been leased on the north flank of the San Mateo Dome, in sections 28 and 34, T. 15N, R. 8W, and sec, 4, T. L4N, R. 8W. In the Poison Canyon area 960 acres were leased in sec. 27 and 28, T. 13N, R. 9 W.

A newly organized firm, *Zia Mining Company*, has made its first 40-ton shipment from the *LaJara* claims on Section 15 in the Grants, New Mexico area. The shipment reportedly assayed 1.53 percent U_3O_8. An exploratory shaft hit ore at 28 feet; stripping operations were then started for an open-pit mine, and future shipments will come from this pit. The ore body is estimated to contain 8,000 to 10,000 tons.



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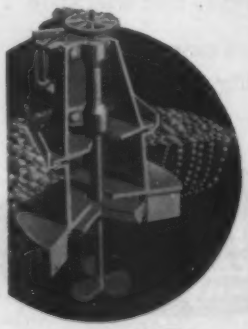

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SOUTHWEST

Average grade of ore in the *San Mateo Project* being developed by *Lisbon Uranium Corporation, Mineral Project Venture-B,* and *E. J. Longyear Company* on property leased from *Yucca Mining & Petroleum Company* is said to be 0.4717 percent U_3O_8. Drilling is now being carried out around the ore body to delineate it.

United States Borax & Chemical Corporation has almost completed installation of equipment at Carlsbad, New Mexico to make a substantial tonnage of high grade muriate of potash for which there is increasing demand.

A Grants, New Mexico prospector, Alfred Hutton, has reported discovery of a copper deposit about 20 miles from Grants in Valencia County.

Mid-Continent Uranium Corporation is reported to have worked out the ore bodies in the *Barbara J* mine in Poison Canyon area of New Mexico, according to the state mine inspector's office. The rails and other mining equipment have been removed, and water is being pumped from the mine for use in other mines in the area.

Mining operations of the *Chino Mines Division* of *Kennecott Copper Corporation* were severely hampered by heavy rains and flooding during August.

The State Engineer of New Mexico has issued new procedures for miners and prospectors who sink mine drill holes or lode discovery holes to depths of 10 feet or more and thereby encounter water. Briefly, these are the procedures: Persons who find water in test holes more than 10 feet deep must report the discovery to the office in Santa Fe, with the driller's log of the hole. If the test hole is abandoned, it must be plugged in such a way that the water will be effectively confined in the stratum. If the hole is to be used as a water well, it must be cased to prevent water from flowing from one stratum to another. Forms for the required reports are available from the state engineer's office in Santa Fe, or from branch offices in Albuquerque, Deming, and Roswell.

TEXAS

The *Reynolds Metals Company's* alumina plant at Corpus Christi, Texas has been named the Sherwin plant in memory of the late R. S. Sherwin, Sr. a former Reynolds vice president, and world authority on alumina production. The plant had formerly been called La Quinta.

The International Mining Days and annual meeting of the *New Mexico Mining Association* will be held in El Paso, Texas, November 7, 8, and 9.

The *United States Geological Survey* has issued a "Preliminary Report on the Stratigraphy of the Uranium-Bearing Rocks of the Karnes County Area, South-Central Texas" which is available for 50¢. The paper presents result of preliminary investigations of this area, and of the correlation of the potentially uranium producing beds in drill holes and surface exposures. Several contacts were mapped in reconnaissance in the area.

U. S. Metals Sinks Shaft Near Wakefield, Michigan

United States Metals Refining Company, a subsidiary of American Metals Company, Ltd., recently began a shaft-sinking project north of Wakefield, Michigan, several miles from the south shore of Lake Superior, where the firm controls approximately 20,000 acres. Ten diamond drills are also in operation. The work is being done in the None-Such formation, the same formation in which the active White Pine copper mine is located, 20 miles to the east.

The 215-foot shaft will be used to determine the character of the formation and for sampling. The Centennial Development Company of Salt Lake City, Utah has contracted the work. Walter Dean, formerly with the Southwest Potash Company in Carlsbad, New Mexico, is in charge of the project.

Revival of Iron Ore Mining in Missouri

Southern Missouri is witnessing a revival of iron ore mining. Within a 100-mile area, from Howell County on the east to Greene County on the west, a closer examination is being made of long-known, but low-grade limonite deposits.

Most of the present workings are shallow, and strip pit methods of mining are in use. Milling practices are crude, for only the richer ore bodies are being mined. At some places the ore is crushed to about eight inches, the sludge washed out, and the chunk ore hauled to the railroad. Other operators are using wooden jigs to do a rough job of concentrating.

The Patillo Mining Company of West Plains is operating a pit in Douglas County, 15 miles south of Mountain Grove, while a Kansas City syndicate is planning a $100,000 investment in the same area. Southwest of Springfield, Bill Craig and Walter Segriest are building a mill near Republic. They have mapped out a thorough drilling campaign of their leases. Quite extensive ore bodies have already been blocked out as a basis for beginning operations.

The St. Louis and San Francisco Railway, as evidence of its confidence in the district, has stationed a switch engine and crew at West Plains to expedite shipments of ore from that point. The "Frisco" reports the movement of over 300 cars of iron ore from southern Missouri during the month of July.

Calumet & Hecla Inc. has completed unwatering of its *Osceola Lode* at Calumet, Michigan, and production has been started. This has been one of the largest underground mine pumping operations in history, and many outstanding "firsts" were achieved. Included are: the use of submersible pumps at a greater mine depth than ever before; use of submersible pumps for other than vertical settings; taking higher electrical voltage to greater depth underground than ever before through one cable; devising a method for protecting pipes against corrosive action of mine water by coating them with synthetic rubber.

Researchers of the *U.S. Bureau of Mines* have developed a process for the recovery of columbium and other valuable byproducts from certain domestic submarginal titanium deposits. Columbium and iron were recovered simultaneously from several low-grade Arkansas materials during tests at the Bureau's Rolla, Missouri laboratories. These included two titanium minerals—brookite and rutile—and two types of alumina plant wastes containing titanium minerals. Essentially the process consists of heating a concentrate with coke to produce a coherent sinter, and then chlorinating the sinter at low temperatures, followed by fractional distillation to recover titanium, columbium, and iron. The report is number R.I. 5349 "Low-Temperature Chlorination of Columbium-Bearing Titanium Minerals," and may be obtained from the Bureau's Publications Distribution Section at 4800 Forbes Street, Pittsburgh 13, Pennsylvania.

Bear Creek Mining Company, exploration subsidiary of *Kennecott Copper Corporation*, is reported to be seeking leases on 250,000 acres of phosphate land in Beaufort County, North Carolina. Low-grade phosphate deposits have been known to exist there for some time, but to be successful, any operation would have to be carried out on a large scale.

Tennessee Coal & Iron Division of *United States Steel Corporation* is exploring for zinc in eastern Tennessee. Seven diamond drills have been moved into a large area under option in Grainger County. This drilling will be done along the eastern flank of the Strawberry Plains syncline. The ore horizon in this area will be from 2,000 to 3,000 feet deep. TCI already operates a mine in adjoining Jefferson County, where operations have been reduced to a four-

Minnesota Celebrates 50 Years of Iron Ore Beneficiation

Fifty years of progress have transformed the first Minnesota iron ore beneficiation plant (left) from a simple pilot plant producing 10,000 tons of concentrate annually into the largest concentrating plant on the Mesabi and Cuyuna ranges, as pictured at the right, producing 1,800,000 tons of concentrate per year. In 1907 United States Steel Company's Oliver Iron Mining Division constructed the first beneficiation plant at Trout Lake, near Coleraine. Ore was graded in a log-washer, a hardwood log cut to an octagonal shape with attached paddle blades. The log was set in an inclined trough and, as it rotated, clay and fine materials were carried off in the pulp overflow. Heavy and coarse materials were paddled out as underflow. The equipment consisted of log-washer, screen, tables, and bowl-type classifiers. In 1939 the heavy media process was developed at the M. A. Hanna Company's Harrison plant. The heavy media process applied only to iron ore coarser than ⅛-inch, and the search for equipment to beneficiate the finer grade ores continued. Other organizations began investigating the use of jigs, and proving successful in the treatment of fine ores, jigs are used in many plants today. Another process, called the Dutch State Mines cyclone heavy media process, was also investigated and is now used by several companies. Oliver's present day Trout Lake concentrating plant pictured above is one of 80 such plants in the Mesabi and Cuyuna ranges. In 1956, 27,701,203 tons of concentrate were produced by beneficiation. This is 43.8 percent of all ores shipped from the iron range. The Golden Anniversary of iron ore beneficiation was celebrated by Minnesota's mining industry in August this year and 22 plants, demonstrating all phases of beneficiation, were opened to the public.

day week because of the current zinc prices.

Davison Chemical Company, a division of *W. R. Grace Company*, is constructing a plant at Erwin, Tennessee to refine rare earths and reactor fuels. The ores for this plant will come from foreign sources.

The *Beryllium Corporation* of Reading, Pennsylvania has officially dedicated its new $4,500,000 beryllium plant at Hazelton, Pennsylvania. Over the next five years, 500,000 pounds of nuclear-grade beryllium valued at $23,000,000 will be produced for the Atomic Energy Commission.

Construction of the *Calloway Mine* B shaft is proceeding on schedule at the *Tennessee Copper Company* property in Copperhill, Tennessee. The shaft, headframe, hoist house, and ore bin are scheduled for completion by the end of this year.

Management of *Appalachian Sulphides Inc.* has decided not to proceed with expansion of production from the *Ore Knob* mine in North Carolina until the price of copper increases. Mill rate is currently about 400 tons per day, averaging three percent copper. Equipment has been installed to increase this to 700 tons daily, but the 400-ton rate will be maintained until the market price rises.

The Superintendent of Documents in Washington, D.C. is offering a valuable bulletin entitled "Bibliography of Iron Ore Resources of the World (to January 1955)." It is Geological Survey Bulletin 1019-D compiled by Gwendolyn W. Luttrell, and contains references to most of the important literature on iron ore deposits of the world. It is available at 65 cents.

Ormet Corporation expects its new $50,000,000 alumina plant at Brunside, Louisiana to go into production early next year. Annual output is expected to be about 350,000 tons of alumina, treating bauxite from South America. The alumina will then be shipped by barge up the Mississippi and Ohio Rivers to Omal, Ohio where a reduction plant, also under construction, will produce 180,000 tons of primary aluminum annually. Ormet is owned jointly by *Olin Mathieson Chemical Corporation* and *Revere Copper and Brass Inc.* Olin will receive 120,000 tons of alumina from the Ormal plant and the remaining 60,000 tons will go to Revere.

Erie Mining Company has taken over operation of the new primary crusher from the contractors at Aurora, Minnesota. First production of iron ore pellets from taconite is expected to start soon. The $300,000,000 project is a joint venture of *Bethlehem Steel Corporation, Youngstown Sheet and Tube Company, Interlake Iron Corporation*, and the *Steel Company of Canada. Pickands Mather & Co.* will be the operating agents; designed capacity is for 7,500,000 tons of taconite pellets annually.

Iron ore from the *Cleveland-Cliffs Iron Company's Sally* open pit, formerly known as the *South Judd* mine, will be hauled to the *Canisteo* mine this winter for treatment in the Canisteo plant next season.

M. A. Hanna Company has formally approved the construction of a combination Humphrey Spiral-froth flotation plant at the *Groveland* mine near Randville, Michigan, and work will move ahead rapidly now. *Bechtel Corporation* of San Francisco has been awarded the contract for engineering and construction of the facilities. Two 2,000-ton units will be built first, but ultimately eight units will be constructed. Operation of the plant is based on pilot plant operation during 1951 at the site of the new plant, plus additional research during the past few years on various processes. Production will be at the rate of 700,000 tons of concentrate yearly with operation scheduled for the spring of 1959. F. H. Lee has been appointed superintendent of the Groveland properties.

Inland Steel Company will build a new sintering plant at its Indiana Harbor Works which will expand its ironmaking capacity by 300,000 tons annually. The plant is part of a $280,000,000, three-year expansion program by Inland which will increase steel making capacity by 15 percent by the end of 1958.

Reserve Mining Company mined 7,329,701 tons of low-grade iron ore (taconite) in the first six months of this year.

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1—Sturtevant Dustless Rotary No. 660, 15 HP Motor
Blowers
1—8000 cfm Buffalo, complete with 40 HP Motor
1—#23 Buffalo, 3 HP Motor
1—Sturtevant Barrell type, 5 HP Motor
Bucket Elevators
3—48' Bucket Elevators, Vertical, 8" X 5" Buckets, complete with steel housing, motor and drive
1—40' Bucket Elevator, Vertical, 8" X 5" Buckets, steel housing, motor and drive
1—50' Bucket Elevator, Vertical, 9" Buckets, steel housing, motor and drive
Classifier
1—30" X 15' Wemco Spiral, complete with 1-½ HP drive
1—48" X 17'3" Akins Spiral, complete with 3 HP drive
1—9' X 24' Dorr Duplex Rake, Model DSFX, 15 HP Motor
Compressors
1—130 cfm Gardner-Denver, Model AAO, Air Compressor, Size 5-⅝ X 5, 20 HP, 220/440 volt
1—Ingersoll Rand 12 X 10, 60 HP, 220/440 volt
1—Ingersoll Rand, Type 30, Size 5 X 3 X 3-½, 5 HP Motor
1—360 cfm Gardner-Denver, Portable, with D-1300 Cat. Engine
Conveyors
1—16" X 152' Belt Conveyor, steel structure and drive
1—22" X 31-½' Belt Conveyor, steel structure and drive
42—9" Screw Conveyors ranging from 10' to 110', complete with steel housing and motor drives
1—10" X 9-½' Oscillating Conveyor, 2 HP TEFC Motor
Crane
1—2 Ton P & H Electric Overhead Crane, 22' span
Crusher
1—4" X 5-½" Morse Bros. Jaw Crusher, 7-½ HP G.E. Motor
1—6" X 8" Straub Jaw, 7-½ HP G.E. Motor
1—10" X 21" Telsmith, B.E. Jaw Crusher
3—36" X 48" Birdsboro-Buchanan, 150 HP Motor
2—60" X 24" Traylor Crushing Rolls
1—#2 McFarland Eggers, Lab. Gyratory Crusher
Dryers
1—18" X 20' Rotary Dryer, complete with oil fired burner, 1-½ HP Gearmotor, 220/440 volt
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6—60 X 78" Apron Feeder
2—24 X 8' Denver, Adj. Stroke, Belt Type, 1-½ HP, new belt, excellent
Elevators
1—7" X 88' long Redler Elevator, horizontal double leg type, 5 HP Motor drive
Filter
1—5' X 6' Oliver Drum, complete with accessories
2—3' X 4' Oliver Drum, complete
1—4'-1 leaf Eimco Disc Filter
1—5'-4" X 6' Oliver Disc Type
1—6'-6 leaf Oliver Disc Type
Flotation Machines
1—6-cell # 30 Denver
2—6-cell # 18 Denver
8—48" Agitair, 2-cell units
Furnaces
1—DFC Assay Type, 25 KVA Electric, complete with controls
1—2-Ton Herault Foundry Furnace, complete—write for specs.

Jigs
2—42" X 42" Pan American Duplex
1—24" X 36" Denver Duplex
2—12" X 18" Denver Duplex
Mills, Ball & Rod
2—8 X 6 Marcy Type Ball, 225 HP Motors
1—6 X 8 Allis Chalmers Ball Mill
2—6 X 9 Allis Chalmers Ball Mills
Mill Balls
450 Tons—6" Forged Steel Mill Balls, new
Pumps, Sand
1—5" Wemco Simplex, Suction-Pressure Diaphragm, ¾ HP Gearmotor
1—2" Wilfley Sand Pump, 5 HP Motor
2—1" Wilfley Sand Pumps
1—3" Wilfley Sand Pump, 15 HP Motor
16—4" Wilfley Sand Pumps, overhead mount motor
Scales
6—Suspension Hopper Scales, 3000# Capacity
1—40 Ton Winslow Truck Scales
Screens
1—3' X 7' Link Belt, Type P.D. single deck
Separator
1—Dings Magnetic Separator, Type E-24, Excellent
Thickener
1—13' X 7' Gardinge Lowhead, complete with motor & drive
Drills, Diamond
1—Longyear, EX, Gas Engine, skidded
1—Knight and Stone, Gas Engine, skidded
1—Sullivan, H815, Gas Engine
Drill
1—22T Bucyrus Erie Blast Hole Drill
Hoists
1—375 HP Wellman-Seaver-Morgan, Double Drum, 14,000# @ 1000 fmp Excellent
1—900 HP Allis Chalmers, Double Drum, 48,600# @ 850 fmp, Post Brakes, Sectional, 900 HP, 500 Volt DC Motor, M-G Set and controls, excellent
1—150 HP Vulcan Single Drum Hoist, 6000# @ 725 fmp, 150 HP Motor, 2300 Volt
Locomotive
2—2½ Ton Greensburg Battery, 24" ga., complete with Batteries
1—1-½ Mancha "Little Trammer," 18" ga.

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IDAHO

Eight carloads of iron ore have been shipped by *E. L. Jones and Associates* from Iron Mountain, Washington County, Idaho, to *Oregon Steel Mills* in Portland, Oregon. A screening jig has been installed and tests are being made to determine if magnetic separation machinery should be added. Drilling and metallurgical testing are in program on the *Mortimer* claims.

The newly formed *Western Mica Association* has asked the Federal Government to install a mica-beryl purchasing depot in Latah County, Idaho. Corville Slette of Moscow, Idaho, heads the organization.

The old *Morning* mine at Mullan, Shoshone County, Idaho, which *American Smelting and Refining Company* started to close as "worked out" several years ago, again is expected to become an economic producer of lead and zinc. An ore body, the Noonday, discovered last winter on the 1250 level, has responded very well to development. Diamond drilling has indicated that values extend both upward and downward.

The Defense Minerals Exploration Administration has approved a $130,840 lead-zinc exploration project at the *Clayton Silver Mines'* property in Custer County, Idaho. Government participation will be 50 percent. The main shaft will be deepened 300 feet and a new working level opened at a depth of 800 feet. Some 2,150 feet of tunneling will be done on the new level. Work is on a one-shift basis so as not to interfere with production of about 100 tons daily from upper levels. On the 500 level, the main North ore body has been found to be at least 70 feet longer than on upper levels. Strike length at last report was 400 feet. Norman M. Smith, Kellogg, is general manager.

A 38-ton shipment of uranium-bearing ore has been made from the leased *Little Bill* property in Custer County, Idaho to a Salt Lake City processing plant. *Western Fluorite Company* of Warren, Arkansas was the shipper.

Deep exploration of the Mineral Mountain area of the Silver Belt between Wallace and Kellogg, Shoshone Count, Idaho, has been undertaken by *Polaris Mining Company*. A 1,500-foot extension of the Chester lateral from the 3,000-foot level of Polaris' *Silver Summit* mine is expected to intersect the main Mineral Mountain vein. The structure was not commercial where opened by Polaris from the 2300 level of the Polaris mine in 1946. Polaris will get half of any production under its contract with *Mineral Mountain Mining and Milling Company* and *Chester Mining Company*.

Good lead-silver ore averaging five feet in width has been opened for more than 300 feet to date on the new 2,450-foot level of the *Lucky Friday* mine east of Mullan, Shoshone County, Idaho. A main pumping station is being installed on the 3,050-foot level. Ore production is around 155 tons daily. Charles E. Horning of Wallace is president of *Lucky Friday Silver-Lead Mines Company*, and Dave Elder is superintendent.

Production of silver-copper ore has been resumed from the Yankee Girl area beneath the property of *Metropolitan Mines Corporation* in Shoshone County's Coeur d'Alene district of Idaho. Output is coming from a stope above the 3200 level near the western boundary. *Sunshine Mining Company* is the operating firm. Metropolitan has asked stockholders to increase capital stock and authorize a public stock offering in connection with its financing of development of the old *Black Bear* silver-lead mine in Burke Canyon, north of Wallace. A. J. Teske, Wallace, is secretary-treasurer.

The Bonanza vein in the *Dayrock* mine north of Wallace, Shoshone County, Idaho, has been opened for 340 feet on the 500 level and for 70 feet above the level at last report. The ore averaged 4.6 feet wide, 20.7 percent lead, and 6.8 ounces of silver to the ton. Shaft-sinking has been completed for a new 1250 level. Henry L. Day, Wallace, is president of *Day Mines, Inc.*, and S. F. Heitfeld, secretary.

Black Dome Mining Company has leased 350 acres of state land in Clearwater and Shoshone counties for "quartz mining." The firm's headquarters are at Tekoa, Washington. M. W. Lyon of Lewiston, has leased 270 acres of state land in Shoshone County, Idaho, and William T. McBurney of Sandpoint, 80 acres in Bonner County, Idaho for "quartz mining."

Pinnacle Drills for Uranium

Exploration of the old Snowstorm copper-silver zone and the Silver Cable vein, which yielded ore from shallow workings many years ago, is now in progress as part of Pinnacle Exploration, Inc. of New York's $1,000,000 exploration program in the east end of the Coeur d'Alene mining region in Idaho (see MINING WORLD, July 1957, Page 79). In the photo above, a diamond drill rig is drilling one of two 1,000-foot holes on Uranium Mines, Inc. holdings. Drilling is done by Vivian Brothers, Kellogg drilling contractors. Pinnacle Exploration, an exploration subsidiary of Callahan Zinc-Lead Company and Vulcan Silver-Lead Corporation, has contracted a profit-sharing agreement with Uranium Mines.

MONTANA

A group of miners from Butte, Montana have been doing exploration work for *Anaconda Company* near Deary, Idaho. Shafts have been sunk into the company's optioned clay property to obtain samples for more detailed analysis of the deposits. Present plans are to use the clay for manufacture of alumina.

The *Montana Gold and Chemical Company* is operating a small, bucket-line floating dredge located about six miles south of Gold Creek. This is said to be the only bucket-line dredge operating in Montana at this time. *Winston Bros.* of Minneapolis recently acquired a giant gold dredge at auction. The dredge was owned by Rupert T. Garrison II and Carl W. Dixon, and had operated in the placer sands of Prickly Pear Creek between Jefferson City and Clancy, Montana. Winston's plans for the dredge have not been announced.

The *Johnny Miller* silver-lead prospect on Swamp Creek, seven miles south of Plains, Montana, now is owned by *Fred M. Viles & Co., Inc.*, of Spokane, Washington. The purchase was made before the recent death of Mr. Miller, 96-year-old Thompson Falls prospector who staked the five-claim property more than 40 years ago and drove 1,800 feet of tunnel to get under a promising surface showing. The Spokane firm has constructed a 1200-foot road to the original discovery.

At the *Lucky Joe* uranium property on the west fork of the Bitterroot River, Ravalli County, Montana, a tunnel is being driven on a phyllite vein structure to gain depth on an outcropping of uraninite-gummite-uranophane mineralization. Because of the spotty character of the high-grade, ore-sorting facilities have been installed to obtain a shipping grade. The operation is a joint venture of *National Uranium Corporation of Idaho* and *Hypotheek Mining & Milling Company*, both of Wallace, Idaho.

The *French Creek Mining Company* is mining gold ore on the *Shaeffer* property located three miles west of Argenta, Montana. Ore is produced in open pits, and hauled about 16 miles by truck to a mill in Bannock for processing.

The *Jefferson Gulch Mining Company* is currently placer mining in Jefferson Gulch, about 20 miles west of Avon, Montana. The washing plant is floated on a pontoon, and is fed by a dragline.

OREGON

A 50-ton flotation mill has been erected by *Standard Milling Company* on Dixie Creek, two miles from Prairie City, Grant County, Oregon. It is designed to handle ore from the *Standard* mine and others in the area. Ray E. Summers, D. L. Olling, and Vernon Jacobsen are company officers.

Lakeview Mining Company has purchased a Mayhew 2000 drill rig for deep

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exploration of its uranium properties in the Lakeview area of Lake County, Oregon.

Chemical Lime Company has started mining operations at its Marble Creek quarry in Baker County, Oregon, and will begin operation of a burning plant at Wing Siding soon. Quarry installations include three 500-ton steel bins, 1,280 feet of new conveyors, jaw and gyratory crushers and feeders. Robert Vervaeke is general manager.

New Delhi Mines Ltd. of Toronto, Canada is erecting a test plant on the site of its lateritic nickel deposits in Josephine County, Oregon in order to conduct an extensive sampling program. Churn drilling and assaying operations over the past few months are reported to have indicated more than 15,000,000 tons of ore.

Frank Phillips is exploring a group of copper prospects in Baker County, Oregon's Lower Powder area. Glen Engle of Baker is in charge.

J. E. Fitzpatrick has been making pilot sampling tests of tungsten ore found near the head of Chicken Creek, Lower Burnt River District, Baker County, Oregon.

Exploration work is under way on Blue Mountain just north of the Spokane Indian Reservation, Stevens County, Washington, to try to locate the source of abnormal uranium content in surface soil downhill from a barren granite-argillite contact. The $45,960 project is being financed with aid of a $34,470 government loan—the first granted by the Defense Minerals Exploration Administration to search for uranium ore indicated by surface geochemical prospecting methods. *Geo-Resource Corporation*, headed by William D. Weaver of Spokane, is the operating company. *Moorehead & Leaf* have been awarded a contract for drilling more than 5,000 feet of diamond drill holes. *Smith Brothers* have a 200-hour bulldozing contract.

Mudhole Exploration, Inc. has built an access road to the scene of its recent uranium discovery south of Mount Spokane, has removed timber, stripped overburden and stockpiled some autunite. Application has been made for a $12,700 federal exploration loan. Adolf Nissen, Spokane, is president.

North Star Uranium, Inc. has been carrying on a $2,772 bulldozer exploration project at its *Lehmbecker* lease in the Mount Spokane district of Washington under a contract with the Defense Minerals Exploration Administration. John F. Campbell of Spokane is president.

J. E. Bayers and Bob Brown of Sulphur, Oklahoma have filed on 12 mining claims in the Lost Creek area of Pend Oreille County, Washington. *Grandview Mines*, Spokane, recently recorded two claims in Stevens County's Northport mining district.

COLORADO

Marcy Exploration and Mining Company has merged with *Shenandoah-Dives Mining Company*. The new *Marcy-Shenandoah Corporation* will control all of the assets of Shenandoah-Dives, and also the *Old Hundred* and *Garry-Owen* properties. Production from the latter is scheduled for the first part of 1958. Plans for reopening the Shenandoah mill at Silverton, Colorado have not yet been completed. Main office of the new firm will be in Durango.

Greasy Sack Mining and Milling Company, formed by a group of local people in the Norwood-Redvale-Naturita area of Colorado to seek uranium, is now exploring a large deposit of phosphate rock in the Klondike area north of Slick Rock, Colorado. The deposit covers about 100 acres. The firm has contacted the *National Farmers Union* about its possible use for fertilizer.

Additional uranium reserves have been developed by *Golden-Cycle Corporation* of Colorado Springs, Colorado on its *Atkinson Mesa* holdings near Uravan in Montrose County, Colorado. A drift was driven to the northwest part of the lease from the main shaft to cut another mineralized area which appears favorable. The firm is also drifting to the southern part of the lease where drilling has indicated another zone. During the first part of 1957, the firm shipped 8,155 tons of uranium ore, compared with 6,405 tons in the latter half of 1956.

Giant Resources Inc. has mined about 2,000 tons of ore since the 1st of June at its *Little Dora* property near Silverton, Colorado. The ore carries values in silver, copper, and gold, as well as lead and zinc.

Superior Mines Inc. of Salida, Colorado is building a new 100-ton mill to process lead, zinc, and silver ores in the Bonanza area of Saguache County. In addition to the mill, the company will operate the *Rawley, Superior*, and *Antora* groups of mines. The mill will also treat custom ore from other operators in the area.

The *Westminster Corporation* of Denver, Colorado has recently acquired all of the assets of *Xtabay Mining and Uranium Company* of Dallas, Texas. Included in the purchase are 260 acres of mining properties in Fremont County, Colorado which are reported to indicate rare earths mineralization, and 420 acres of potential uranium-bearing property also in Fremont County.

Yellow Queen Uranium Company is reported to have received approval for a DMEA loan to drill its property in Golden Gate Canyon, west of Golden. This is the *Front Range* mine which has already shipped some uranium ore.

The 1957 *Rocky Mountain Minerals Conference* will be held at the Cosmopolitan Hotel in Denver, Colorado, October 30, 31, and November 1. L. J. Parkinson is program chairman.

The *Little Nation* lead-zinc-silver mine at Howardsville in San Juan County, Colorado has been purchased by H. H. Davault of New Florence, Missouri, and T. I. Tritch and Glen Davis of St. Louis. Plans of the new owners have not yet been announced.

Juniper Oil and Mining Company of Denver, Colorado has subleased uranium property of *Cotter Corporation* in the Tallahassee Creek area near Canon City, Fremont County, Colorado. The firm will mine one ore body containing about 27,000 tons of ore, and will retain an overriding royalty. Cotter has approval from the AEC to build a pilot plant at Canon City. Juniper has also been exploring 51 unpatented claims in the Marshall Pass area in Saguache County.

Work was conducted this summer in the *East Ridge* mine in the Black Bear Basin area near Ouray, Colorado, after a road to the property was opened.

Warren Oil & Uranium Mining Company Inc. of Denver, Colorado has voted to change its name to the *Westminster Corporation*.

SOUTH DAKOTA

Giant Cycle Corporation has been formed by *Giant Resources Inc.* and *Golden Cycle Corporation*, each with a half interest in the new firm. The new company has already acquired the properties of *Triangle Enterprises* with proven reserves of about 50,000 tons of uranium ore, and a completed incline shaft. Giant Cycle now owns or controls about 8,000 acres. All ore will be shipped to the mill at Edgemont, South Dakota, owned and operated by *Mines Development*.

UTAH

Bear Creek Mining Company has completed its 1,080-foot Burgin shaft in the Tintic district of Utah. *Centennial Development Company*, actual contractors on the job, have now received another contract calling for 2,000 feet of exploratory drifting and prospecting. Bear Creek recently resumed negotiations with *Zuma Uranium and Oil Corporation* over the Zuma properties in the East Tintic district.

Union Carbide Nuclear Company has completed about half of its two-compartment shaft which it is sinking in the Summit Point area of San Juan County, Utah. A number of drill holes have already blocked out about 15,000 tons of carnotite ore.

Vanadium Corporation of America is reported to have opened a uranium vein on the *Farmer John No. 3* claim in the Marysville district of Piute County, Utah. Much of the property in this area is leased from *Bullion Monarch Uranium Company*.

The AEC has cancelled the copper schedule for copper-uranium ores purchased at the Monticello, Utah ore buying station. Copper-uranium ores tributary to the Monticello plant have, in the past, been purchased under special contracts by the AEC. No copper-uranium purchase contracts are currently in effect at Monticello.

Royal Corporation, formerly *Royal Uranium Corporation*, is conducting an extensive drilling and exploration pro-

Mining 300,000,000-Ton Trona Deposit

Aerial view of Intermountain Chemical Company's trona mine and soda ash refinery west of Green River, Wyoming where a third shaft was completed late last year. Drilling has proven more than 300,000,000 tons of trona ($Na_2HCO_3 \cdot NaHCO_3 \cdot 2H_2O$) with a mineable thickness averaging 10 feet. The deposit has very flat dips so room and pillar mining with off track loading equipment and conveyor belt haulage is used. The three round vertical shafts are about 1,500 feet deep. All ore is hoisted through the No. 2 shaft shown in picture. It is also an exhaust air shaft. No. 1 shaft is used for air exhaust and as the main supply shaft for men and materials. No. 3 shaft is used for air exhausting. The refinery, a part of which is shown, has complete facilities for ore storage and crushing, dissolving and filtering, crystallization and crystal setting to produce both a light and dense soda ash. Both types are high purity sodium carbonate and are used extensively in western metallurgical plants.

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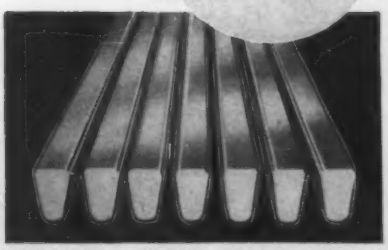

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gram for uranium in the Indian Creek area of San Juan County, Utah.

Geophysical and geochemical prospecting is now being undertaken on the claims in the Ophir district of Tooele County, Utah leased by *New Park Mining Company* from *Silver Standard Mining Company* and *National Treasure Mining Company*. The company is seeking base metals.

Golden Cycle Corporation has acquired a half interest in the *Potts* mine and other adjacent property from *Black Bear Consolidated Mining Company*. The uranium property is in the Marysvale district of Utah.

WYOMING

Western Nuclear Corporation has submitted to the Atomic Energy Commission for approval a proposal for expanding the daily milling capacity of the Jeffrey City, Wyoming mill from 400 to 1,200 tons. President Robert W. Adams contends that an increase in the firm's uranium reserves warrants the expansion. The mill was completed July 11, and dedicated in September.

Western Nuclear Corporation's proposal is the fifth which has been placed before the Atomic Energy Commission affecting rapidly increasing ore reserves of Wyoming. *Vitro Minerals Corporation* has asked for an uranium chemical concentrator to up-grade ores from its property for shipment to its mill at Salt Lake City. *Fremont Mineral Corporation* has asked for a mill at Riverton. *Globe Mining Company* and *Union Carbide Nuclear Company* have submitted a joint proposal to construct a 1,000-ton mill, although no site has been announced. *Lucky Mc Uranium Corporation* and *Phelps Dodge Corporation* have submitted a proposal which would expand the Lucky Mc Corporation mill now under construction in the Gas Hills from 750 to 1,750 tons per day.

Continental Uranium Company has started a vertical shaft on the *Gaddis* claims which it controls in the Crooks Gap uranium area of Wyoming. Continental is mining from a deep pit just south of the *Wyoming Uranium Corporation* property where $42,000,000 worth of ore has been reported blocked out by *Phelps Dodge Corporation* drilling. James H. Ternahan Jr. is project manager.

De Los Rios Mining Company obtained an injunction to prevent any more beryl ore being taken from the *Whippett* claims on Bridger Mountain in north Fremont County, Wyoming. Judgment was obtained by default when defendant M. B. Molyneaux and others did not appear to contest. The court also ruled that $365 be paid the plaintiffs by the government for ore that Molyneaux had shipped to the buying station at Custer, South Dakota.

Fremont Minerals Inc. has pinpointed Riverton as the site for its proposed $7,000,000 uranium ore processing mill in Wyoming. General Manager Allen D. Gray told Riverton civic leaders that the 750-ton-a-day installation would be erected at that town when negotiations are completed with the Atomic Energy Commission for the sale of concentrate. Gray said his firm plans to build a complex, multiple circuit mill capabale of handling any ore now known in Wyoming.

A new uranium claim staking rush is in progress in the Shirley Basin, north of Medicine Bow, Wyoming, where major companies and individuals staked over 1,000 claims during the last two weeks of July. The rush started when drilling information of *Teton Exploration Drilling Company*, an original claim staker in the area, apparently leaked out. Among the companies known to be operating in the area are *Tidewater Oil Corporation, Kerr-McGee, Shoni Uranium Corporation*, and *Utah Exploration Company*. Teton Exploration has some 1,800 acres, 780 by lease. In October 1956 the Teton properties were optioned to K. C. Heald of Fort Worth, Texas, who holds a one-year option. Heald completed 35,000 feet of drilling during the past year. The Shirley Basin contains much the same lithology as the Gas Hills in the Wind River Basin, with the upper Wind River formation drawing the main interest. Source material is similar to the Gas Hills, with the drainage from the tuffaceous White River formation and granite to the northeast against the dip of the Wind River formation.

The State Attorney General has claimed for the state of Wyoming the mineral rights on *Union Pacific Railroad* right of way where it crosses school land granted to the state by the federal government. Concerned are around 1,000 acres; the railroad crosses 28 school sections in Wyoming with its 200-foot right of way. The action was taken as a result of a recent U. S. Supreme Court decision holding mineral rights on railroad right of way crossing public lands belonging to the federal government.

The *Westminster Corporation* has purchased over 2,200 acres of mineral leases in the Pumpkin Buttes area of Campbell County, Wyoming. Several active uranium mines are producing in the vicinity. The geology and mineral structure is also said to indicate the possibility of oil sands.

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Nickel-Cobalt Development Proceeds at Moa Bay, Cuba

The Cuban-American Nickel Company, a subsidiary of Freeport Sulphur Company, has completed negotiations for financing a $100,250,000 nickel and cobalt development project at Moa Bay, Cuba (see MINING WORLD, May 1957, page 91). Backing was received from United States banks and several large nickel consumers, who will have a call on large portions of the nickel to be produced.

Work has already begun on the project and it is scheduled for operation in the middle of 1959. Annual production of 50,000 pounds of nickel per year and 4,400,000 pounds of cobalt is expected. Ore will be concentrated at the Moa Bay plant and shipped to Freeport's refinery at Braithwaite, Louisiana, where a new process for recovering nickel and cobalt metals will be used.

Earlier this year the United States Government agreed to buy nickel and cobalt metals produced from Cuban-American's new facilities. The government will buy up to 271,000,000 pounds of nickel metal and 23,835,000 pounds of cobalt metal at current market prices during a period to end June 30, 1965.

Burma Plans New Methods For Mine Development

The Government of Burma has given consideration to methods of developing the country's mining industry and has declared a new mining policy.

According to the Deputy Prime Minister, U Kyaw Nyein, development of the mining industry will be undertaken in three sections: by the state, by joint ventures between the government and private enterprise, and by private enterprise. The government will undertake only those sections of the industry which cannot be handled by private enterprise, such as the production of coal and iron, and the development of minerals in remote places where the private investor would be wary of operating.

The government will launch certain enterprises jointly with existing foreign firms. Private enterprises will be allowed to function without fear of nationalization. The Deputy Prime Minister frankly stated that nationalization of the mining industry would not benefit the state, and that private mining will receive all-out state support. Laws governing the employment of foreign capital are to be revised, and facilities will be created for the withdrawal of capital and remittance of profits to foreign investors.

It was also suggested that all of the Chambers of Mines be combined into a centralized association in order to enable more consolidated representation.

Indian Plant Construction Progresses on Schedule

Construction of the three government-sponsored steel plants at Bhilai, Rourkela, and Durgapur, India continues to progress according to schedule.

At the German-financed Rourkela Steel Plant, orders were placed with 21 German firms for various sections of the main steel plant and engineering work for the coke ovens and the blast furnaces has begun. A dam is being built across the Sankh River in Orissa to provide a year-round water supply for the steel works. Erection of the housing project is also progressing satisfactorily.

Russia is supplying the bulk of equipment for the plant at Bhilai. Over 23,000 tons of steelwork have been imported from Russia thus far. Civil engineering at the site is done by two Indian firms and orders have been placed in India for construction equipment and engineering and electrical supplies.

Development of iron ore mines at Dalli Rajhara, 60 miles from the Bhilai steel works, has also been undertaken by Russia and a railroad connecting the steel works and iron mines is almost completed. Construction of a railroad to a limestone quarry at Deorjhal, about 12 miles from Bhilai, is now underway.

Work is also in progress at the Durgapur, near Calcutta, with the backing of several British firms.

Foreign Investors Aid Yugoslavia Expansion

Development of Yugoslavia mineral deposits continues to expand, with the help of foreign capital. According to recent reports, copper production will be doubled within the next four years; lead production is expected to increase from 50,000 to 100,000 tons per year; and production from newly developed lead and zinc mines is scheduled for the middle of 1958.

French and Belgian investors will supply $40,000,000 for a four-year, $58,000,000 copper development program. The Majdenpek copper mines will be put into production at the rate of 10,000 tons of ore daily and copper smelters at Bor will be expanded to produce 55,000 tons of electrolytic copper per year. Processing at the new plants will also yield approximately 2,500 kilograms of gold and 40 tons of silver, as well as selenium and 230,000 tons of sulphuric acid over a 75-year period. The sulphuric acid will be used in the production of superphosphate at a new factory at Prahovo, where production is expected to be 575,000 tons annually.

Construction of a 50,000-ton capacity aluminum plant at Titograd, Montenegro has begun following an agreement with the Soviet Union and East Germany to provide financial and technical assistance. Construction will start immediately at the power plants and the entire project is expected to be completed in 1964.

Lead-zinc production will be stepped up with the re-opening of the Srebencia mine in Bosnia and the development of a new mine at Kiznica.

Production Doubled at Italy's Largest Open-Pit Asbestos Mine

S. Vittore-Balangero (Torino), owned by Societa Amiantifera di Balangero, recently doubled the mining rate and crushing capacity of its open-pit asbestos mine in Torino, Italy, and increased the number and capacity of drying plants and separation plants. Storage facilities were also enlarged and warehouses at the separation plant were completely renovated and expanded. Production is now 32,000 metric tons of fiber per year. This is 98 percent of the asbestos produced in Italy and 53 percent of that produced in western Europe. Deep drilling has proven that ore reserves are available for further increase in production. More than 750,000 tons of ore are mined each year and more than 200,000 tons of waste stripped. At present production rates, the proven reserves will last more than 30 years. The "Glory-hole" method of mining has been abandoned. An open pit has been developed using machine drills and modern blasting techniques. Ore is loaded with shovels and hauled by truck to the nearby mill. Pictured above is a partial view of the mine showing the 48-foot-high benches with trucks and shovels in action, the abandoned "Glory-hole" in the foreground, and at the right the mill and tailing dumps. S. Vittore's asbestos is used for cement-asbestos, for brakes and coupling clutches, and for floor-tile.

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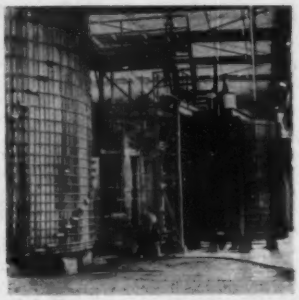

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SOUTH WEST AFRICA—*Industrial Diamonds of South Africa (1945) Ltd.* reports it has discovered a new diamond terrace in its Saddle Hill holdings in the Luderitz district. This terrace is being opened up and initial limited prospecting has disclosed recoveries of 821 carats per 100 loads from 352 loads of sand and gravel mined.

LIBERIA—The *Liberian-American-Swedish Minerals Company (LAMCO)* is reported to be proceeding with plans for development of the *Sanniquellie* iron ore deposits in the northern central province of Liberia. A port will be built south of Monrovia, and will require a 300-mile railroad to transport ore from the mine. The company is a joint Liberian-American-Swedish venture managed by the Swedish firm of *Grangesberg A.B.* Other participants are the Liberian Government, *International African-American Corporation, Atlas Copco, Nordstroms Linbanor, Svenska Entreprenad A.B., Skanska Cement A.B.,* and *Ifoverken.*

MOROCCO—Except for iron, cobalt, and copper ores, output of all Morocco's mines showed a big improvement in the first six months of this year, as compared with the same period in 1956. Phosphate output was increased from 2,865,115 metric tons to 2,964,729 tons; lead ore from 61,326 to 62,600; zinc ore 31,051 to 44,611; metallurgical grade manganese 193,019 to 210,684; chemical grade manganese from 17,020 to 34,389; and salt from 3,156 to 17,322 tons. Iron ore production in the south zone declined slightly from 224,287 metric tons to 219,045; cobalt ore from 3,700 to 1,199 tons; copper ore from 1,578 to 1,107 tons; and barite from 13,275 to 4,739 tons.

FEDERATION OF RHODESIA & NYASALAND — *Nchanga Consolidated Copper Mines Ltd.*, which is increasing its treatment plant capacity to 360,000 tons a month, has completed extensions for a rate of 300,000 tons monthly, compared with the 1956-1957 average of about 259,700. When the plant has been completed to its full rated capacity, about 240,000 tons per month will be drawn from the *Nchanga West* ore body, about 80,000 tons from the *Nchanga* open-pit, and 40,000 tons a month from the *Chingola* open-pit. The Nchanga open-pit is almost ready for initial mining operations. The Chingola open-pit, which lies to the southwest of the other ore bodies, will facilitate the mining of a relatively small, high-grade, shallow ore body; initial stripping operations in the overburden are underway and the first ore is expected to be drawn early in 1958. The main purpose of opening-up three ore bodies is not any immediate increase in copper output, but to impart greater flexibility in mining and metallurgical operations, and thereby achieve the most economical production of metal. At 31st March this year, the estimated ore reserves were about 164,400,000 tons averaging a little more than 4.5 percent copper, of which the Nchanga ore bodies of about 154,730,000 tons averaged 4.55 percent copper, and the Chingola ore body of about 7,380,000 5.68 percent copper. The 1956-1957

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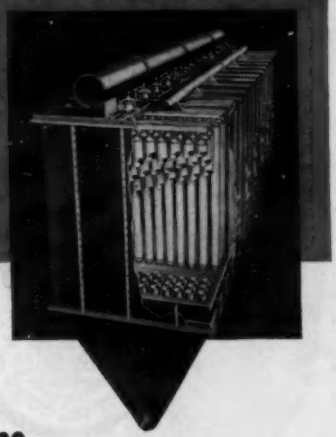

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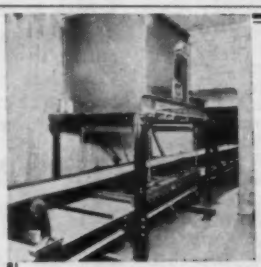

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mill grade was 4.99 percent copper, and the copper recovery was 87.06 percent.

LIBERIA—The *Liberian Mining Company* is reported to have come to an agreement with the Liberian government for development of iron ore deposits near the Mano River. Under terms of the country's new foreign investment formula, the government has an equity of 50 percent, private investors 35 percent, and the company 15 percent. *Republic Steel Company* has a large interest in the Liberian Mining Company.

ANGLO-EGYPTIAN SUDAN—A large copper deposit has been reported in the Bahr el Ghazak province in the southern Sudan area. According to the Ministry of Mineral Resources, preliminary estimates have indicated ore reserves totalling around 1,000,000 tons. Geologists searching for minerals made the discovery.

UNION OF SOUTH AFRICA—*Union Tin Mines Ltd.*, which for the past year has had difficulties associated with lower-grade ore and extraction problems arising from iron oxide in the ore, has exposed in development work sufficient areas of better grade ore to permit the resumption of restricted stoping operations. Output of concentrates has improved, and the previous working loss substantially reduced.

BELGIAN CONGO—*Belgian Aluminium Syndicate* has joined with the *Afral Group*, Swiss, German, Italian, and French interests, and the *Reynolds Metals Company* in a plan to establish an aluminum industry in the Belgian Congo. A production of 500,000 tons annually is being considered. This would require additional port facilities because the existing ports of Boma and Matadi would not be able to cope with this increased tonnage. A committee is now studying the possibilities of developing ports along the upper estuary between Boma and Matadi. (Above this point, the Congo River is no longer navigable.) If it is possible to find a workable solution to the problem, then consideration will be given to establishment of a hydroelectric plant at Inga, which is less than 100 miles from the mouth of the Congo River.

FEDERATION OF RHODESIA & NYASALAND — *Rhodesian Selection Trust Exploration Ltd.* has been granted on extension to September 30 of next year on its prospecting license which covers 31 square miles near the Tsngwezi River. Expenditure by the company is now expected to be about £10,000.

CHILE—*Compania Minera Cerro Negro* has discovered copper deposits near Cabildo in the province of Aconagua. The deposits are said to contain several million tons of about 3.0 percent Cu.

CUBA—*Jeanette Minerals Ltd.* of Toronto, Canada is reported to have blocked out 200,000 tons of manganese ore averaging 25 percent Mn on its six-claim *Arivass* property. Mining and milling equipment for a 200-ton-per-day operation are being assembled. The company also holds a nickel prospect in Oriente province.

BOLIVIA—*Placer Development Ltd.*, which operates among other interests the *Bulolo* gold dredging project in New Guinea and *Pato Consolidated Gold Dredging* in Colombia, is reported to be negotiating with the Bolivian government for permission to erect a tin concentrator. The latter would treat the dumps at *Catavi*, formerly owned by *Patino Mines & Enterprises Consolidated Inc.*

COLOMBIA—During the six-month period ended June 30, 1957, *Pato Consolidated Gold Dredging Ltd.* dredged 12,395,000 cubic yards to recover 49,814 ounces of fine gold, compared with dredging of 13,407,000 cubic yards to recover 110,910 ounces in the same period of 1956. During this period, the No. 2 dredge was unproductive while undergoing repairs and alterations and moving to a new location. In the second quarter of the year, dredges No. 1 and 4 were digging flotation towards new dredging sites with a consequent reduction in revenue.

CHILE—The *National Foundry Company* reportedly has asked a United States expert, Frederick S. Mallet, to make a survey for the best site for installation of a new copper refinery in Chile. Construction of the new electrolytic refinery has been agreed upon, but selection of a site had been the subject of much discussion. Several cities have wanted it.

MEXICO—Otto A. Richter of Torreon, state of Coahuila, and Jesus Guzman are developing the *Noria de San Pantaleon* mine located 20 kilometers southwest of Sombrerete, state of Zacatecas. This mine was operated 20 years ago by *Inversiones del Oro*, and then was closed down as an unprofitable development. The ore now

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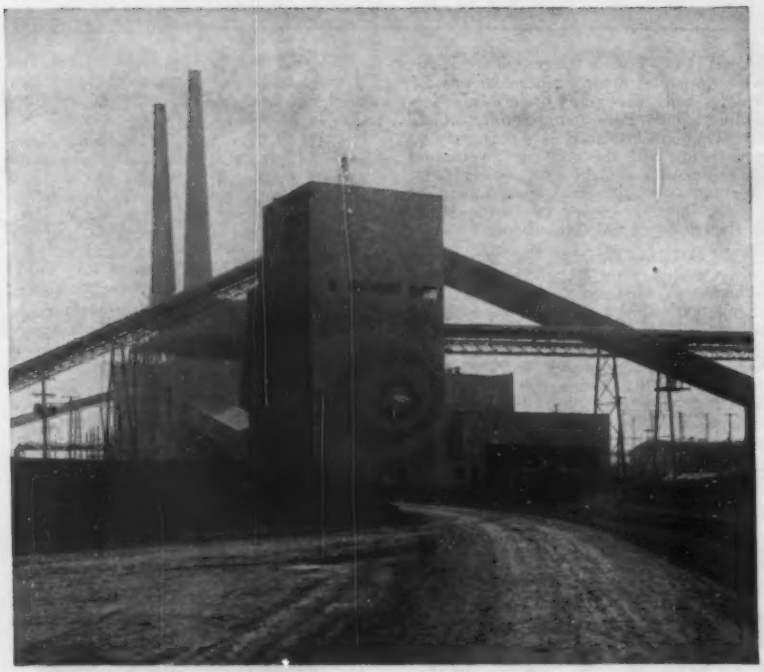

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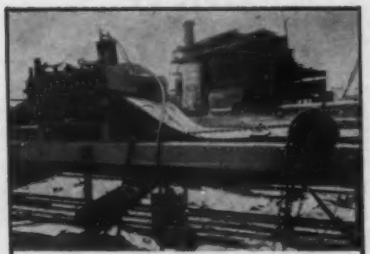

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being mined is running 600 grams of silver, 6 percent copper, and 8 percent lead per ton. Mr. Guzman is acting as general manager.

PANAMA—The country's mineral deposits are said to be attracting the attention of several mining companies. The *Rosario Exploration Company* reportedly is developing manganese deposits in the Rio Boqueron area of Colon province. Two United States aluminum companies are said to have filed for bauxite mining rights in Colon, Veraguas, and Chiriqui provinces. Another U.S. firm is reported to be interested in a copper concession near Tole.

COLOMBIA—*Bulolo Gold Dredging Ltd.* has permanently closed down its No. 4 dredge after depletion of its gravel reserves. No. 5 dredge is now the only dredge operating along with the hydraulic mining on the *Widubosh* lease. For the year ended May 31, 1957, 8,246,600 cubic yards had been dredged to recover 51,827 ounces of fine gold, compared with 11,339,200 yards in the previous year for a recovery of 40,134 ounces fine gold.

PERU—*Volcan Mines Ltd.* has stopped work at its *Carahuacra* mine and concentrator, and has reduced the operation of the Ticlio concentrator by about 80 percent. These properties are high in the Peruvian Andes, more than 15,800 feet above sea level. Several other Peruvian mining companies have also reduced their operations because of the declining prices of lead and zinc.

MEXICO—A 47,665-hectare mining zone in the state of Oaxaca has been removed from the jurisdiction of the *Commission for Mining Development* and turned over to the *National Nuclear Energy Commission* for exploration and development of uranium, thorium, and other redioactive metals, according to the Economy Minister. Mining concessions already granted in the region, which takes in the municipalities of Telixtlahuaca, Sosola, and Etla, will not be affected by the new decree.

BRITISH GUIANA—It has been reported that the *North West Guiana Mining Company Ltd.* plans to produce 10,000 tons of manganese monthly, starting in 1959, with a rise to 30,000 tons by 1961. The company is operating in the northwest district near the Venezuelan border. The company plans to construct a 38-mile railroad to bring the ore to a shipping point.

OCEANIA

NEW SOUTH WALES—*Australian Iron and Steel Ltd.*, a subsidiary of *Broken Hill Pty. Company Ltd.*, is making further extensions to its expansion program. On the inner harbor, now being dredged, No. 4 blast furnace is under construction and a new battery of coke ovens (96 ovens, the second largest battery in the world) is being built. Further expansion of steel rolling capacity will go hand in hand with these projects. The recently completed tin plate plant is working smoothly. Output in the first instance is 70,000 tons per year.

REPUBLIC OF THE PHILIPPINES—*General Base Metals Inc.* has signed a contract with the Japanese firm of *Mitsubishi Shoji Kaisha* for the delivery of 15,000 tons of manganese at $30.00 per ton. Prior to this a 3,000-ton shipment of 44 percent Mn was made to the Japanese company at $36 per ton.

NEW ZEALAND—*Kanieri Gold Dredging Ltd.* at Taramakau handled 402,000 cubic yards of gravel in July for a recovery of 1,301 ounces of bullion, or about 950 ounces of fine gold. This is the dredge which formerly worked at Kanieri, about 15 miles away. It has been in operation at Taramakau for about a year, after a transfer that took two years. The Taramakau property has about 15 years of life at present treatment rates. Costs will need to be low in order to show a profit on the present 1¾ grain per yard recovery, but the throughput of the dredge is certainly high.

REPUBLIC OF THE PHILIPPINES—*Acoje Mining Company* suspended chrome shipments for a time while new facilities were installed to speed shipments and cut down cost of loading. The equipment included new conveyor loading facilities at the company pier in Zambales, and additional production facilities.

NEW GUINEA—*New Guinea Gold and Petroleum N.L.* is prospecting two gold lodes about 250 feet below the present open cut workings near Edie Creek, Papua.

REPUBLIC OF THE PHILIPPINES—*Atlas Consolidated Mining and Development Corporation* set a new all-time high in production in July by milling 316,554 tons of ore for a recovery of 7,072.5 dry short tons of copper concentrates, containing 3,601,322 pounds of copper and 1,202.3 ounces of gold. During that month, Atlas also shipped from its *Mati* iron mine a total of 15,944 metric tons of iron ore.

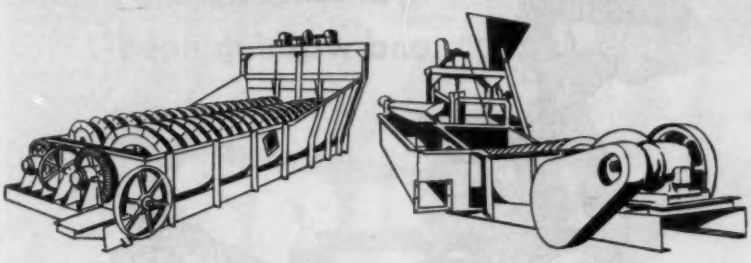
CHRISTMAS ISLAND — Phosphate production on the island is expected to be more than doubled by 1961 as a result of an expansion program. This has been revealed by three officials of the Phosphate Commission who report that expansion over the next four years will bring output from 350,000 tons to 800,000 tons. The Australian Bureau of Mineral Resources is currently planning an intensive three-year search for phosphate deposits through Australia and its territories, and New Zealand will conduct a similar search, sharing in the cost. Australia needs 1,300,000 tons of phosphate rock annually, with this now being supplied by Nauru and Ocean Island in the Pacific, and Christmas Island in the Indian Ocean.

NEW ZEALAND—Arrangements have been made to ship 25 tons of iron sand from New Zealand's west coast annually to an Australian electronics manufacturer. There are hopes that this sand, of which there is an inexhaustible supply, may also provide New Zealand with its own steel industry. New techniques in smelting have overcome earlier production difficulties, but the electric power problem must still be solved, and it is doubtful that the industry would be economic at the Dominion's current rate of consumption.

NEW GUINEA — *Consolidated Zinc Pty. Ltd.* is testing the *Astrolabe* copper field near Port Moresby which was

CIW COST-CUTTING EQUIPMENT

AKINS CLASSIFIERS AND HEAVY MEDIA SEPARATORS



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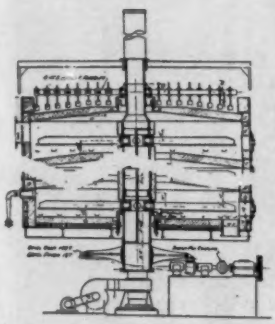

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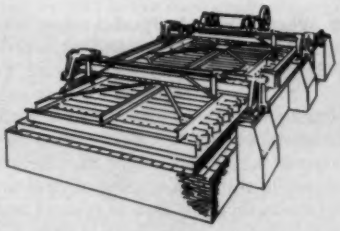

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worked between 1920 and 1939. At the end of that period, 100 white men and 1,000 natives were employed.

NORTH AMERICA

QUEBEC—*Continental Iron and Titanium Mining Ltd.* has started to produce high-grade ilmenite for special purposes, and rutile production is scheduled for later this year. The company operates an ilmenite plant at Baie St. Paul which produces a high density product. About 12,500 tons of this were sold to the U.S. Atomic Energy Commission for use at one of its nuclear accelerators. A 200-ton-per-day rutile plant is being constructed which will produce 12 tons of rutile daily and 100 tons of byproduct ilmenite concentrate. The company's deposits are in the St. Urbain area.

MANITOBA—*Mangava Nickel Mines*, one of the newer firms in Manitoba, plans to diamond drill five magnetic anomalies indicated by recent geophysical work on its property. The company's holdings are in the Partridge Crop Lake area between that lake and Lake Natawahunan. Mangava also has made a superficial investigation of 62 claims it has acquired in the Moak Lake area.

SASKATCHEWAN—*Black Bay Uranium Mines* has completed sinking a three-compartment shaft to a depth of 610 feet at its *Fishhook Bay* uranium property. Ore and waste passes will be driven, and skips installed for efficient hoisting. Ore shipments are expected to start this winter to the *Lorado* custom mill. First shipments will be from the company's stockpiled ore at the *Murmac Bay* property in the same general area. The plant and other equipment from Murmac Bay have been moved to the new Fishhook operation.

QUEBEC—*Bateman Bay Mining Company* has started shaft sinking at its *Dore Lake* copper-gold property in the Chibougamau area. Objective is to bottom the shaft at 580 feet, and to cut stations at 250, 375, and 500 feet. This will be followed by crosscutting and drifting to develop ore indicated by surface drilling. The plant is about completed.

ALASKA—*Bear Creek Mining Company*, exploration subsidiary of *Kennecott Copper Corporation*, is continuing exploration of the *Ruby Creek* copper property north of the Kobuk River. The property had formerly been developed by Riny Berg of Chitina and Jack Bullock of Kotzebue. A road to the property has been built by *Dahl Creek Mining Company* for Bear Creek.

SASKATCHEWAN—A huge 40-ton crane has been shipped by *Potash Company of America* from Carlsbad, New Mexico to its Canadian operation at Saskatoon where the company is sinking a 3,000-foot shaft. The crane will be used on heavy construction work at the project.

QUEBEC—*New York and Honduras Rosario Mining Company* is proceeding with geological mapping and electromagnetic surveying, to be followed by magnetometer checks, on a property in Roy Township optioned from *Newlund Mines*. A limited amount of drilling done

earlier this year showed values in zinc and copper with some silver.

ONTARIO—Eight of the smaller companies in the *Rio Tinto Group* have proposed to amalgamate, and to continue as one company under the name of *Frederick Consolidated Mines Ltd.* Approval of the respective stockholders is now being sought. Involved in the merger are the following firms: *Big Game Mines Ltd., Pitchgoma Mines Ltd., Grand Chibougamau Mines Ltd., Frederick Mining and Development Ltd., Plympton Uranium & Metal Mines Ltd., Conecho Mines Ltd., Moon Lake Uranium Mines Ltd.,* and *Plum Uranium & Metal Mining Ltd.*

ALASKA—Dismantling of the *Alaska Juneau Gold Mining Company* property at Juneau is underway. Between 3,000 and 4,000 tons of scrap iron from the mine have been shipped to Kobe, Japan for the *Daiichi, Bussan Kaisha Ltd. Machinery Center* of Salt Lake has the contract for disposal of scrap and equipment. Alaska Juneau has been shut down since 1944.

BRITISH COLUMBIA—*Western Nickel Limited* has made fixed price contracts for the sale of substantial quantities of nickel to European buyers in 1958, 1959, and 1960. It is now preparing for production from its reopened mine near Choate. Initial production is to be at a rate of 400 tons of ore daily. *Pacific Nickel Mines Ltd.* owns 40 percent of the stock of Western Nickel and *Newmont Mining Corporation* owns 50 percent. The nickel-copper concentrate will be treated at the refinery of *Sherritt Gordon Mines* at Fort Saskatchewan. *Granby Consolidated Mining Smelting and Power Company* will manage mine operations.

EUROPE

SPAIN—A newly formed company, *Asturiana de Zinc,* will build an electrolytic zinc plant at Aviles, near the smelter owned by *Compagnie Royale Astruiene des Mines.* The latter has a 40 percent interest in the new firm. The remaining 60 percent has been subscribed by Spanish concerns. The new plant will have an initial capacity of 12,000 tons of zinc per annum.

GREECE—*Mycobar Mining Company* has officially opened its new mill for processing of barite on the Greek island of Mykonos. The barite will be processed into drilling mud for use by oil drillers. Mycobar is a joint venture of *Magnet Cove Barium Corporation* and *Mykonos Mining Company.*

SWEDEN—A uranium extraction plant with an esimated output of 100 tons of uranium per annum, is said to be under consideration by *A.B. Atomenergi.* The plant would be located at Mt. Billingen in West Sweden, and would process 2,000 tons of shale per day. Also under consideration is an expansion of activities at Kvarntorp in central Sweden where the present output of 5 tons of uranium per year is expected to be increased to 10 tons shortly.

U.S.S.R.—An iron and manganese ore deposit is being developed at Karazhal (Kasachstan). The main shaft is nearing completion. Part of the ore will be crushed on the spot in a mill with a capacity of 1,200,000 tons annually. The crushing plant will work in two sections, one for iron ore and the other for manganese. During the first half of 1957, Russia produced 41,300,000 tons of iron ore, an increase of eight percent over the first half of 1956.

UNITED KINGDOM — *Mond Nickel Company Ltd.* has been authorized by the British Board of Trade to sell 1,600 tons of nickel pellets from the strategic reserve held by the Board. Sales will be made for consumption in the United Kingdom at the normal selling price, and as far as possible will be spread over the period from September 1957 to June 1958.

YUGOSLAVIA — Bauxite output from Yugoslavia this year is estimated at about 927,000 metric tons. This includes 220,000 tons from the *Niksic* mines, 237,000 tons from *Mostar,* 213,000 tons from *Drnis,* 200,000 from *Rovinj,* 47,000 from *Bosanska Krupa,* and 10,000 from *Risan.* Additional bauxite processing facilities are expected to be erected to treat large untouched reserves, such as the 6,000,000 tons estimated in the Zadar area, 2,500,000 tons in the Makarska area, and 1,200,000 at Jajce.

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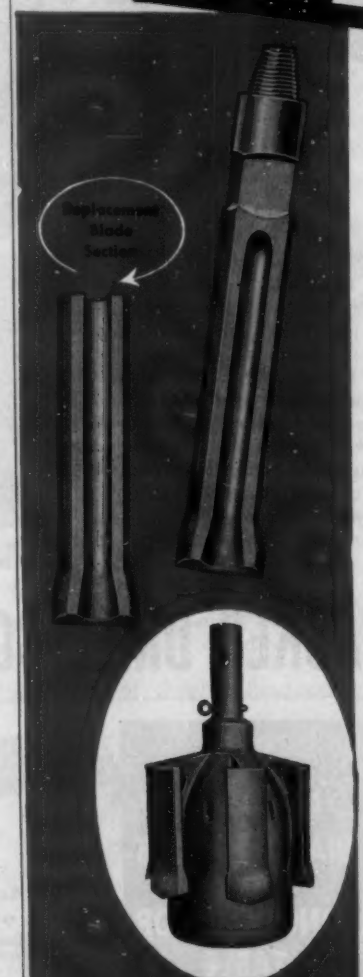

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INTERNATIONAL

INDIA — *Indian Copper Corporation Ltd.* is carrying out a considerable amount of exploratory work at the *Surda* mine and the *Patharghoa* prospect. The majority of the newly blocked out reserves which amounts to nearly 100,000 tons is the result of development work at the *Mosaboni*, however, where known ore shoots are being opened up. Total reserves are a little under 3,500,000 tons, averaging 2.5 percent copper.

JAPAN—Japanese copper smelters are cutting production of electrolytic copper because of the current slump in the Japanese copper market. The reduction may be about 20 percent which would bring monthly output down to between 10,000 and 11,000 tons.

JORDAN—Anwar Malhas, a Jordanian financier, is reported to have received the first concessions for uranium mining in the country. The concession is said to cover a 300 square mile area in the Araba region in the southern part of the country. Prospecting is under way.

MALAYA—Production of iron ore in Malaya increased by more than 500,000 tons in the first five months of 1957 over the corresponding period of last year.

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The 1,199,596 tons produced in a five-month period, compares favorably with the 2,444,570 tons total production for 1956. May output was the highest this year—275,823. Also in the first five months of this year, Malayan bauxite production increased by nearly 24,000 tons to 122,306.

TURKEY—A joint United States-Turkish company has been formed to process old chrome dumps and tailings. If a good method can be found for reworking the old dumps, this could be a promising venture.

INDIA—The government of India has approved a proposal by S. P. Choudhuri to set up a small pig iron smelting plant on the west coast of India where Mr. Choudhuri has located an iron ore deposit. The government has also agreed to grant a mining lease for this specific purpose. He is now seeking financial and technical assistance from overseas sources. Details can be secured from Mr. Choudhuri in Bombay (Post Box 1884).

JAPAN—*Ishihara Industrial Company* is considering setting up a European subsidiary to handle marketing of titanium dioxide. Japan's exports have been steadily increasing this year, and Ishihara feels that it is necessary to have a European outlet in order to make prompt delivery. The company will probably be set up in Brussels, Belgium. Plans are to keep about 300 tons of stock (titanium dioxide) on hand.

KOREA—The *Changhang* smelter is now refining about 90 tons of copper per month, as well as about 1,000 pounds of silver and 112 pounds of gold. When the final phase of modernization of metallurgical processes is completed, the plant is expected to increase production to 350 or 400 tons of copper per month, one ton of silver, and as much gold as can be recovered from the ore. Production of lead, now being extracted in small quantities, will be expanded to be a minimum of 200 tons monthly. The *United Nations Korean Reconstruction Agency* has allotted $1,555,742 for the work on this plant.

BURMA—*Tavoy Tin Dredging Corporation Ltd.* reports that its dredges in the Tavoy district and Mergui district have resumed operations. Insurgents had prevented production for some years. The company holds the *Theindaw* property in the Mergui district and the *Kyaukmedaung* property in the Tavoy area.

INDIA—The port of Redi on the Arabian Sea has been recently developed for the exclusive shipment of iron ore from the rich deposit areas of Redi about four miles from the coast in Ratnagiri district, Bombay state. As a special case, the government has permitted ad hoc export of iron ore from this port since is is not an authorized port under Sea Customs Act 1878. Shipment is made mostly to Japan.

PAKISTAN—It is reported that under the new constitution, the responsibility for the grant of mining concessions, other than mineral oil and natural gas minerals required for production of nuclear energy, iron ore, manganese, tungsten, and vanadium, has been passed from the federal government to the provincial governments. The latter groups are setting up their own organizations for the granting of these concessions. The government's Department of Mineral Concessions has now been changed to Department of Petroleum and Minerals, with headquarters in Karachi.

V-75 Vibrator on tipple bin feeding coal to cleaning plant conveyor

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U.S.A. Metal & Mineral Prices

METALS

		September 17, 1957
COPPER:	**Electrolytic.** Delivered F.o.b. cars, Valley basis	27.00¢
	Lake. Delivered, destinations, U.S.A.	27.00¢
	Foreign Copper. Valley basis	27.00¢
	Custom	26.00¢
LEAD:	**Common Grade.** New York	14.00¢
ZINC:	**Tri State Concentrates,** 80% lead, per ton	$170.52
	Prime Western: F.o.b. E. St. Louis	10.00¢
	Prime Western: Delivered, New York	10.50¢
	Tri-State Concentrate, 60% zinc, per ton	$56.00
ALUMINUM:	**Primary 30 Pound Ingots (99% plus).** F.o.b. shipping points	28.10¢
ANTIMONY:	**Lone Star Brand.** F.o.b. Laredo, in bulk	33.50¢
BISMUTH:	(In ton lots) price per pound	$2.25
CADMIUM:	**Sticks and bars.** 1 to 5 ton lots (Price per pound)	$1.70
COBALT:	**97.99%,** keg of 550 pounds (Price per pound)	$2.00
COLUMBIUM:	**Powder** Nom., per pound	$120.00
GERMANIUM:	**Germanium:** dioxide, high purity, gram	24.00¢-30.00¢
LITHIUM:	**98%** (per pound)	$11.00-$14.00
	Carbonate	82.00¢
MAGNESIUM:	**Ingots (99.8%).** F.o.b. Velasco, Texas, per pound	36.00¢
MERCURY:	**Flasks.** Small lots, New York	$246.00-$250.00
NICKEL:	**"F" Ingots (5 pounds).** F.o.b. refinery, Port Calbourne, Ontario	75.50¢
PLUTONIUM:	To July 1, 1962 AEC will pay $30.00 to $40.00 per gram depending on plutonium 240 content. July 1, 1962 to June 30, 1963, per gram	$30.00
SELENIUM:	**99.5%,** per pound	$10.50
THORIUM:	per kilogram	$43.00
TIN:	**Grade A Brands.** New York (Price per pound) Prompt delivery	93.00¢
TITANIUM:	**99.3%** + Grade "A" Sponge (Price per pound)	$2.25
URANIUM:	**Nominal,** per kilogram	$40.00
U-235:	**Nominal,** per pound	$7,725
GOLD:	**United States Treasury Price**	$35.00 per ounce
SILVER:	**Newly mined domestic.** United States Treasury price	90.62¢
	Foreign Handy Harmon	91.125¢
PLATINUM:	**Per Ounce**	$82.00-$87.00
ZIRCONIUM:	**Sponge, Per Pound,** Nominal	$10.00

ORES AND CONCENTRATES

BERYLLIUM ORE:	**10 to 12% BeO.** F.o.b. mine, Colorado	$46.00 per unit
	Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at $400.00 per short ton or by assaying at: 8.0 to 8.9% BeO, $40 per unit; 9.0 to 9.9%, $45; over 10.0%, $50.	
CHROME ORE:	F.o.b. railroad cars eastern seaports. Long tons dry weight.	
	African (Rhodesian). 48% Cr_2O_3. 3 to 1 Ratio	$55.00-$56.00
	African (Transvaal). 48% Cr_2O_3. No Ratio	$38.00-$39.00
	Turkish, 48% Cr_2O_3. 3 to 1 chrome-iron ratio	$59.00
	U. S. Government ore purchase depot Grants Pass, Oregon. Base price, lumpy ore, $115.00; fines and concentrates $110.00 for 48% Cr_2O_3 and a 3 to 1 chromium-iron ratio. Premiums for higher grade ore and for a ratio up to 3.5 to 1. Penalties for grades down to 42% Cr_2O_3.	
COLUMBIUM-TANTALUM ORE:	At United States small lot beryl purchase depots. $3.40 per pound contained combined pentoxides in 50% ore. Includes 100% bonus. (Government stopped buying temporarily May 12)	
	Per Pound Pentoxide.	$1.15-1.35
IRON ORE:	**Lake Superior. Per gross ton Lower Lake Ports**	
	Mesabi, Non Bessemer, 51.5% Fe.	$11.45
	Mesabi, Bessemer, 51.5% Fe.	$11.60
	Old Range Non Bessemer.	$11.70
	Old Range Bessemer.	$11.85
	Swedish, Atlantic Ports. 60 to 68% Fe Contracts, Per Unit	25.00¢
MANGANESE ORE:	**Metallurgical grade.** 48 to 50% Mn. Long ton unit	$1.40-$1.45
	Metallurgical grade. 46 to 48% Mn. Long ton unit	$1.35-$1.40
	Metallurgical grade. 44 to 46% Mn. Long ton unit	$1.30-$1.35
	Domestic U. S. Government ore purchasing depots: Butte, Montana; (black and pink ores) base price of $4.87 per long dry ton of 18% manganese ore Phillipsburg, Montana; base price of $6.43 per long ton of 15% manganese ore. Small lot program f.o.b. railroad cars, minimum 40% Mn. Base price (48%) $2.30 per unit with premiums and penalties.	
MOLYBDENUM CONCENTRATE:	**90% MoS_2 F.o.b.** Climax, Colorado. Per pounds of contained molybdenum, plus cost of containers	$1.18
TUNGSTEN CONCENTRATE:	**Domestic.** 60% WO_3 Per short ton unit Government not buying	$55.00
	Foreign. 65% WO_3 Per short ton unit (Scheelite)	$12.75
	Foreign. South American, Spanish, Portuguese	$13.50
URANIUM ORE:	**Carnotite-Roscoelite.** F.o.b. purchase depot or company mill plus $0.06 per ton mile ($6.00 maximum), Grand Junction, Rifle, Durango, Naturita and Uravan, Colorado, Salt Lake City, Marysvale, Thompsons, Moab, Green River, Mexican Hat, and Monticello, Utah, Shiprock, and Grants, New Mexico, Edgemont, S. Dakota, Jeffrey City, Wyoming, Tuba City, Arizona. Base price for 0.10% ore is $1.50 per pound and up to $3.50 per pound of contained U_3O_8 plus $0.75 per pound for each pound in excess of 4 pounds per short dry ton and an extra allowance of $0.25 per pound for each in excess of 10 pounds. A $0.50 per pound development allowance paid on all ore purchases. Special lime schedule applies at Monticello, Moab and Grants. No lime penalty with no vanadium payment or lime penalty with vanadium payment.	
VANADIUM ORE:	**Carnotite-Roscoelite.** V_2O_5 in ratio of more than 10 parts to 1 part of U_3O_8 are generally acceptable at all AEC depots, but excess not paid for at Marysvale, Monticello, and Bluewater. Shiprock has no limit on V_2O_5 to U_3O_8 ratio and all contained V_2O_5 is paid for	Per Pound V_2O_5 $0.31

NON-METALLIC MINERALS

BENTONITE:	**Minus-200-mesh.** F.o.b. Wyoming points. Per ton in carload lots	$12.50
FLUORSPAR:	**Oil Well grade.** Packed in 100 pound paper bags	$14.00
	Metallurgical grade. 70% efective CaF_2 content per short ton F.o.b. Illinois-Kentucky mines	$40.00
	Mexican. 70% F.o.b. border	$24.00-$24.50
	Acid Grade. 97% CaF_2, Bulk, F.o.b. Kentucky, Illinois, Colorado	$50.00
	Government buying F.o.b. producer's shipping point: 60% Illinois-Kentucky, $34.50 per ton, others $28.50; 70% Ill.-Ken. $38.50, others $32.50.	
PERLITE:	**Crude:** F.o.b. mine per short ton	$3.00 to $5.00
SULPHUR:	**Plaster grades.** Crushed and sized. F.o.b. plants	$7.00 to $9.00
	Long ton, F.o.b. Hoskins Mound, Texas	$25.50
	Export	$30.50

LONDON METAL AND MINERAL PRICES

		Per Long Ton		September 17, 1957 USA Equivalent cents per pound
COPPER:	**Electrolytic spot**	£204	10s 0d	25.56¢
LEAD:	**Refined 99%**	£ 90	10s 0d	11.31¢
ZINC:	**Virgin, 98%**	£ 75	15s 0d	9.47¢
ALUMINUM:	**Ingot, 99.5%**	£197	0s 0d	24.625¢
ANTIMONY:	**Regulus, 99.6%**	£222	10s 0d	27.81¢
TIN:	**Standard, 99.75%**	£739	0s 0d	92.38¢
TUNGSTEN:	**Long ton unit**	1145		$13.68
		With Sterling pound at $2.80.		

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Personalities

Continued from page 82

S. Norman Kesten Osburn has been named assistant chief geologist of American Smelting and Refining Company's Northwest Mining Department in Wallace, Idaho. Mr. Kesten has been employed with the company since 1952.

A. J. Cayia, president of Inland Steel Company's Canadian subsidiary, Caland Ore Company, Ltd., retired August 1. Mr. Cayia began his career as a draftsman with the M. A. Hanna Company in 1914. He progressed to assistant consulting engineer and general superintendent of Wakefield Iron Company's open pit mine before joining inland Lime and Stone Company in 1928 as general superintendent of operations. Inland Lime and Stone is a division of Inland Steel Company. He was promoted to vice president and general manager and finally president of the company. In 1956 he became president of the Canadian operations at Steep Rock Lake, Ontario.

Hadden F. Sears has been appointed superintendent of mines of Pickands Mather & Co.'s subsidiary, Erie Mining Company, at the new plant in Hoyt Lakes, Minnesota. Mr. Sears previously served as mine superintendent of the Corsica mine and Cuyuna district mines of Pickands Mather. **Olaf T. Berge**, former assistant chief district engineer, has been promoted to district mining engineer for Erie Mining Company. Other staff appointments at the new plant include: **R. F. Kohn** as superintendent of plant operations; **Earl Johnson** as ore dressing superintendent; and **Kenneth R. Groll** as agglomerating superintendent. Mr. Johnson joined Pickands Mather's staff in 1948 as general plant foreman and assistant plant superintendent at the preliminary taconite plant. Mr. Groll has been at Hoyt Lakes since 1955, working on design and construction of the commercial pelletizing plant. **Robert W. Bell** has been assigned the position of mine superintendent of pits No. 2 and 3, and **Robert C. Baxter** is now mine superintendent of pit No. 1. Both men were formerly assistant mine superintendents.

Howard C. Pyle has been named as the American Institute of Mining, Metallurgical, and Petroleum Engineers' nomination for president for 1958. Mr. Pyle, a director of the Institute since 1955, is president, director and chairman of the executive committee of Monterey Oil Company and director of the American Petroleum Institute and Western Oil & Gas Association. Other AIME nominations are: **Arthur W. Thornton**, assistant to the vice president of operations, National Tube Division, United States Steel Corporation and director of AIME, nominated as vice president; **John C. Kinnear, Jr.**, general manager of the Nevada Mines Division, Kennecott Copper Company, nominated as vice president for one year and director for three years; **Elmer A. Jones**, manager of the Southeast Division of St. Joseph Lead Company, nominated director for three years.

Roger L. Tenney, mining engineer, recently joined the staff of the Health and Safety Activity of the United States Bureau of Mines with headquarters in Duluth, Minnesota. Mr. Tenney was employed as assistant chief mining engineer with the Braden Copper Company in Rancagua, Chile, prior to service with the Bureau of Mines.

P. N. MILES (above) will succeed **ALAN CONNER** as manager of the Mining Sales Division of Christensen Diamond Products Company. Mr. Conner is currently directing operations at Castle Concrete Company, a subsidiary of Christensen. Mr. Miles, a University of Utah graduate, has been directly concerned with the sale of diamond bits and allied equipment to the mining industry since he joined the company in 1951. By error, a picture of HARRY L. MILLER, superintendent of mines for the American Zinc Company of Tennessee, was printed in the August issue.

Ian K. MacGregor has accepted a position with Climax Molybdenum Company as vice president of Eastern Operations in New York City. Mr. MacGregor was previously general manager of Manning, Maxwell and Moore, Inc. of Stratford, Connecticut.

John C. Barnett, junior engineer with the International Minerals and Chemical Corporation at Bartow, Florida, was recently promoted to project engineer. **R. C. Maybery, Jr.**, former junior geologist, was promoted to geologist.

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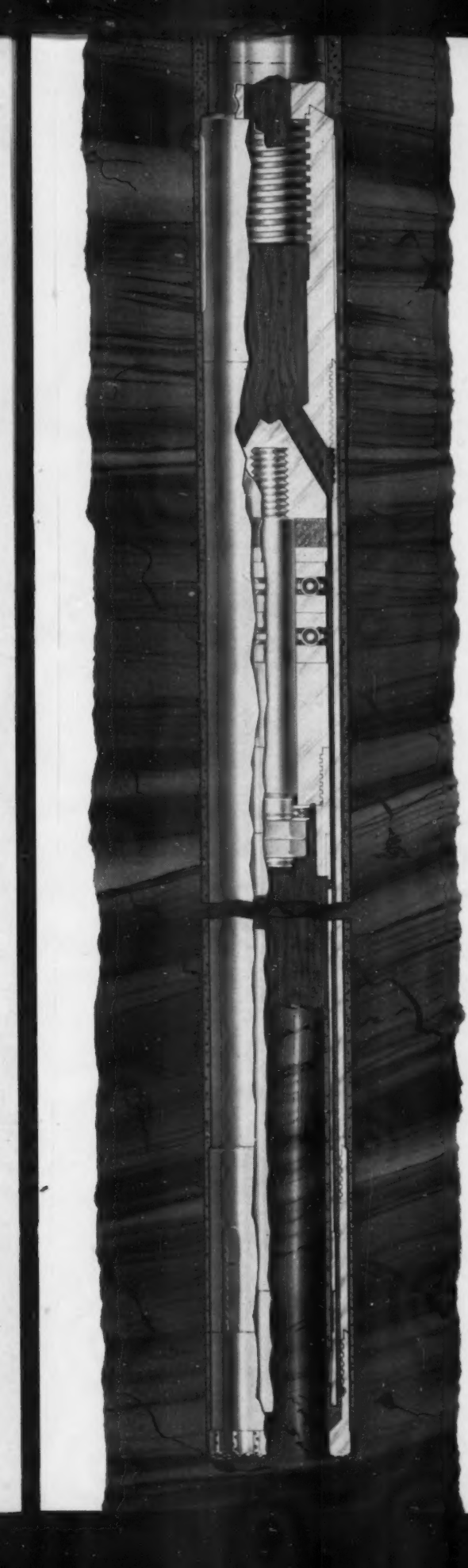

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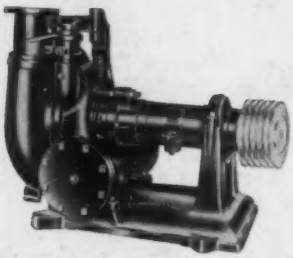

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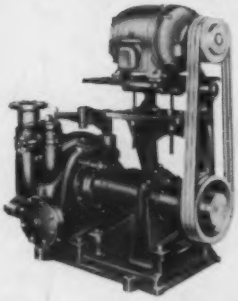

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